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A BROOD STUDY OF THE CODLING MOTH

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INTRODUCTION

No phase of the life history of the codling moth is more important from the standpoint of control than the number and succession of broods. This part of the creature's natural history determines the periods during which fruit and foliage must be kept covered with a poisonous coating.

The influence of climate on the metabolism of the moth is such that the study of broods gives different results for every section. It is probable that if we knew the exact effect of the climate we could form a close estimate of the number of broods, the dates of their appearance and duration in any locality, providing the climate of that locality were known. In the absence of this exact knowledge we are compelled to make a brood study of this insect in every region where its work is important.

It has long been assumed that Kansas has two broods of codling moth, but the evidence of recent investigation indicates the presence of a partial third brood. In the year 1910, the tabulation of moth emergence at Parker, Kansas, indicated the emergence of a partial third brood which was not supported by records of larval emergence. In the year 1911, Mr. L. M. Peairs, working in northeastern Kansas, observed evidences of a third brood which he published in the JOURNAL of ECONOMIC ENTOMOLOGY, Vol. 5, pp. 243–245.

In the year 1912, the writer planned a careful cage study of the broods for the purpose of demonstrating the presence or absence of a third brood in that state. Cages were employed, because in view of the overlapping of the broods the claims for third brood, based on records of

[1] The data on which this paper is based were collected by the writer while head of the department of entomology and zoölogy in the State Agricultural College and Experiment Station of Kansas.

larval emergence and work, pupation, and emergence of adults have never seemed absolutely conclusive.

Sources of Material Used

Table Showing the Transformation of the Larvæ Collected During June, July, August, September, October and November, 1911.

Number	Larvæ collected during	Number which pupated in 1911	Number which pupated in 1912	Number that died
8	June 1911	2	0	6
85	July 1911	68	0	17
196	August 1911	93	48	55
371	September 1911	0	145	226
359	October 1911	0	98	261
140	November 1911	0	15	125

More than 800 larvæ emerging during the late summer and fall of 1911 were enclosed in cotton-plugged glass vials and stored as the weather grew cold in a box 20 inches below the surface of the ground. In this box they were adequately protected from moisture. Forty-eight larvæ were collected from the trunks of apple trees on March 29, 1912, and enclosed in vials in a similar manner.

Pupation in the first group reached the maximum by or before May 7, 1912 and ceased May 28, all that were alive transforming. Adult moths began to emerge May 16, reached the maximum by May 27, and ceased June 15. Pupation of the second group began April 15. Adult moths began to emerge May 11, reached the maximum by May 23, and ceased by May 27.

Breeding Cage Arrangements

The first tree-cage consisted of ordinary screen wire tacked over a wooden frame which was 18 feet square and 18 feet high. This cage was set up May 15, 1912, over an unsprayed Jonathan, which stood about 17½ feet high and filled the cage well. The tree was at once very carefully gone over for eggs of the moth; but none were found, and the trunk and larger branches were very carefully "wormed."

The second tree-cage, made of similar size and of similar material, was completed over another unsprayed Jonathan apple tree on June 1, 1912. The trunk and larger branches were carefully "wormed" and all eggs and all wormy apples removed at intervals of a few days to June 27.

The third tree-cage was the first cage removed from the Jonathan apple tree and placed over a Salome apple tree on July 27, 1912. The

trunk and branches were carefully "wormed," all eggs removed to August 6, and all apples showing traces of infestation to August 12.

Actual Breeding

Moths to the number of 163 drawn from sources described already in this paper, and therefore of the first brood, were introduced into the

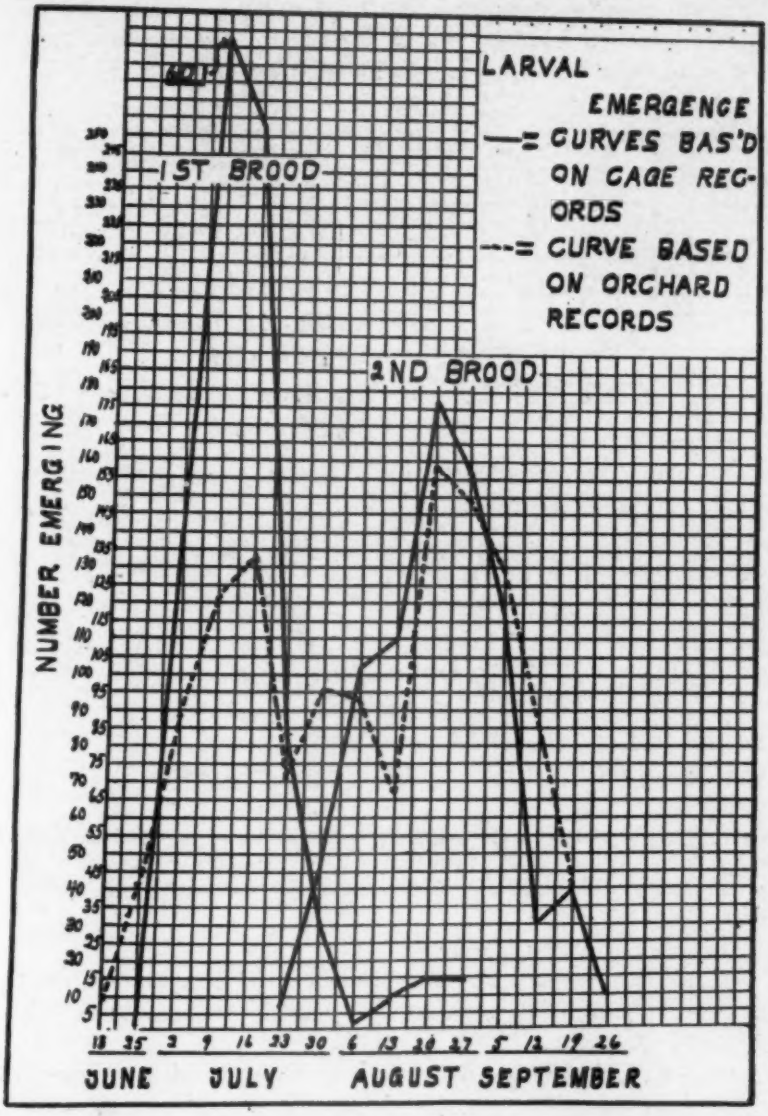

Fig. 7. Chart representing the number of appearances of each stage of the codling moth and the period occupied by each appearance, as shown by cage studies.

first tree-cage as follows: May 25–29, 27–28; 28–30; 29–6; 30–15; 31–7; June 1–13; 2–12; 4–4; 6–8; 7–4; 10–1; 11–4; 14–2.

The first eggs appeared on May 27 and the last were found on July 4. The first worminess became evident on June 4, and the maximum (using this term to mean one-half of all that appeared) worminess was reached between June 24 and 28. The first of the 1123 larvæ that came from this tree appeared under the bands on June 24, the maximum was reached by July 5 and the last emergence came July 31. Pupation of these larvæ began on June 26, reached the maximum July

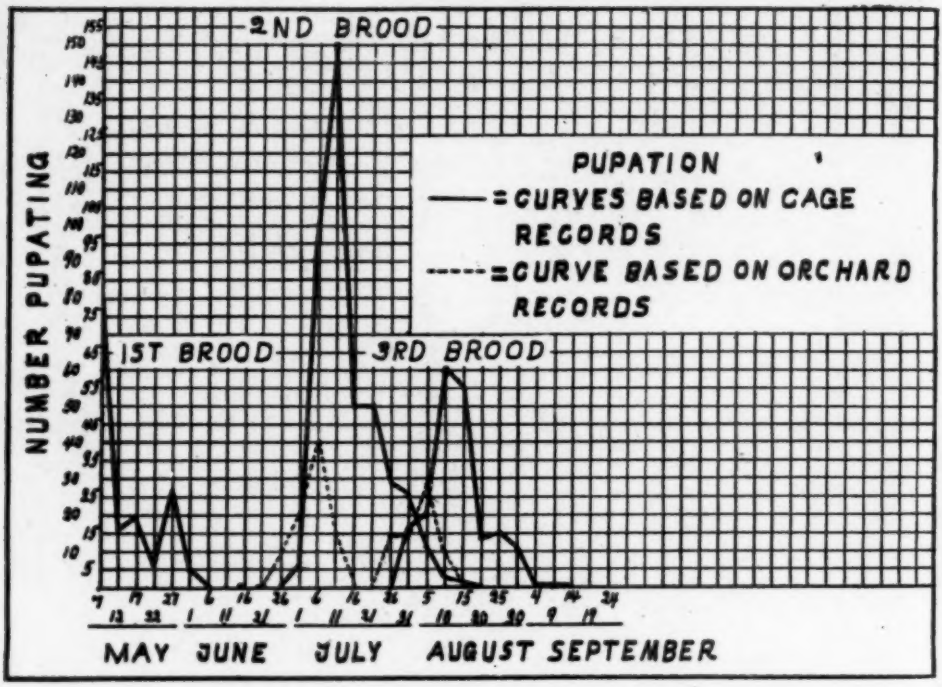

Fig. 8. Chart representing the number of separate pupation periods as shown by cage and field studies in 1912. The pupation of overwintering brood in the orchards was represented by too small a number to render the construction of a curve worth while.

10 and ceased August 11. All larvæ either transformed or died. Emergence of adults began July 5, reached the maximum July 23 and ceased August 21.

Three hundred and seventy-six of the moths which emerged from the first tree-cage were introduced into the second tree-cage as follows: July 5–9; 6–10; 7–17; 8–18; 9–17; 10–12; 11–20; 12–27; 13–40;

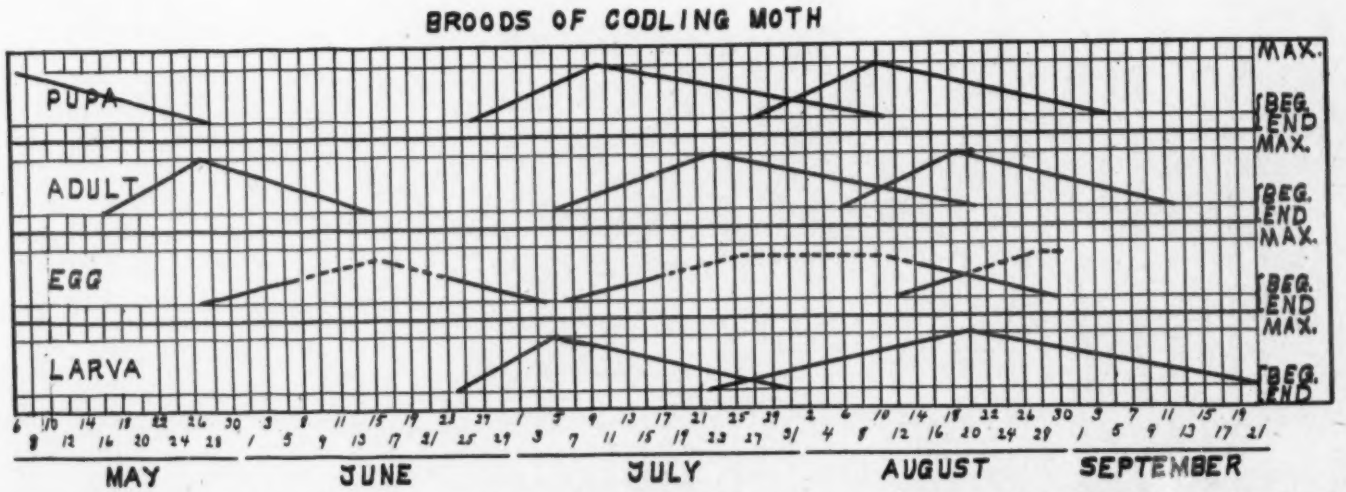

Fig. 9. Chart representing the number of separate moth emergence periods as shown by cage and field studies in 1912. The emergence of the overwintering brood in the orchards was represented by too small a number to render the curve significant.

14–35; 15–16; 16–10; 17–8; 18–63; 21–18; 22–11; 23–13; 24–8; 25–4; 26–6; 29–14.

The first eggs of which we could be certain came July 6 and the last about August 30. The maximum of worminess was reached between July 21 and 24. The first of the 673 larvæ appeared under the bands on July 22, the maximum number by August 20, and they ceased coming by September 21. Pupation of these larvæ began July 27, reached the maximum August 10 and ceased September 5; 48 per cent of the larvæ which emerged from this cage transformed, while 52 per cent

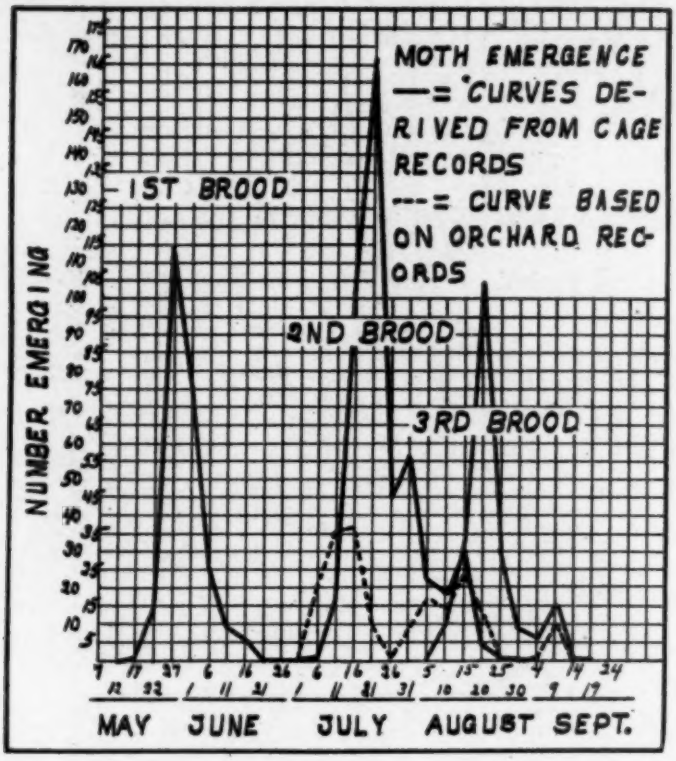

Fig. 10. Chart representing the number of separate larval emergence periods as shown by cage and field studies in 1912.

entered the winter as larvæ. Emergence of the moths began August 6, reached the maximum August 19 and ceased September 12.

Seventy-seven of these moths were placed in the third tree cage as follows: August 6–3; 7–1; 8–2; 11–2; 12–4; 13–5; 14–3; 15–3; 16–7; 17–9; 18–11; 19–10; 25–1; 26–2; 27–1; 29–2; September 1–3; 5–5; 6–2; 12–1. The first eggs appeared August 12, and the first evidence of worminess was detected August 18.

Actual Number of Broods

In Fig. 7, the succession of each stage of the insect is graphically set forth. Three separate and distinct emergences of adult moths are shown. Three definite egg-laying periods are indicated. Three distinct pupation periods are set forth. Two distinct larval emergences are charted. Thus it appears that in 1912, in the course of the outdoor tree-cage studies at Manhattan, three distinct and successive appearances of each of the codling moth's stages, except of larval emergence, were determined. The third emergence of codling moth larvæ would come during late September and October. In view of the fact that larvæ emerging during late September and October in 1911, pupated and produced moths in the spring of 1912, it seems entirely likely that these larvæ of the third brood matured, emerged, hibernated, pupated, and produced moths in the spring of 1913.

The fact that only 48 per cent of the larvæ of the second brood pupated this season, shows that the third brood is only partial.

That the record obtained from cage breeding sets forth substantially what happened in the field is shown by the close correspondence between pupation, moth emergence, and larval emergence curves derived from the cages and from field records as illustrated in Figs. 8, 9, and 10.

That the two full and a partial third brood cycle is not confined to the year 1912 is shown by the fact that the moth emergence for 1910 clearly indicated three broods.

The failure of the curves of larval emergence derived from band records to indicate a third brood for the years 1910 and 1911 is due to the fact that the late second brood so overlaps the small third brood as to cause the collection to grade steadily down to the end, while the same phenomenon in 1912 is due to the fact that the data for late September and October are not available to the writer.

Therefore, it seems very likely that the codling moth normally experiences two full broods and a partial third at Manhattan, Kansas.

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Sworn to and subscribed before me this 12th day of September, 1913.

A. Hartwell Balcom, Notary Public, Melrose Highlands, Mass.
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ON THE PUPAL INSTAR OF THE FRUIT-TREE LEAF-ROLLER (ARCHIPS ARGYROSPILA WALKER)[1]

By W. M. Davidson, *U. S. Bureau of Entomology, Walnut Creek, Cal.*

During the summer of 1911 the writer found occasion to study the pupal instar of the Fruit-tree Leaf-roller at San Jose, Cal.

In California the larvæ of this insect hatch from the winter eggs at about the time when the fruit buds are just beginning to open. This period varies with the season and is usually from the last week in February to the third week in March, as at least three weeks elapse from the time of the opening of the buds of the earliest until that of the latest varieties of fruits attacked. Pears, plums, prunes, cherries and apples are infested, the greatest damage occurring on the three first-mentioned varieties. The larvæ at first feed inside the bud and protect themselves further with a web, but later they repair to the foliage and, inhabiting the upper surface of the leaves, cause the characteristic rolling. Pupation takes place in the rolled leaf, the chrysalis at first being green and soon changing to dark brown.

A large number of larvæ, mostly in the final larval instar, were collected May 8 and 9 and placed in a jar. Each day this jar was inspected and the pupæ that had transformed were removed to separate glass vials, over the mouths of which cheese-cloth was stretched in order to allow of free passage of air. Out of 102 pupæ obtained, 25 perished before reaching the adult stage. No parasites issued from these twenty-five. In the field, especially towards the end of the pupal period, a fair percentage of the pupæ were parasitized. Of the 77 adult moths which issued, 47 were females and 29 males, the remaining individual escaping before its sex could be ascertained. The total average pupal period was 19.9 days, the length of the stage varying from 16 to 23 days. The average pupal period for the 47 females was 19.8 days and for the 29 males 20.3 days. In Colorado in 1912 Gill[2] found that the pupal stage occupied on the average 11.25 days and covered a period from May 28, until the last week in June. He records [3] that the maximum period of pupation was reached from about June 12 to June 20, and that pupæ could be found in the field as late as July 10. In California the writer found that the maximum pupation period took place in the field about May 20, and that live pupæ could be found as early as April 24, and as late as July 1.

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[1] Published with the permission of the Chief of the Bureau of Entomology.

[2] Gill, "The Fruit-tree Leaf-roller"; U. S. Dept. Agr. Bur. Ent. Bull. 116, pt. 5, p. 98.

[3] Ibid. p. 99.

RECORDS OF THE PUPAL INSTAR, San Jose, Cal., 1911

No. individual	Date of pupation	Date of adult emergence	Pupal period days	Sex of moth
1	May 8	May 31	23	Female
2	9	26	17	Male
3	13	June 2	20	Female
4	13	2	20	Female
5	13	2	20	Male
6	13	3	21	Female
7	13	3	21	Female
8	13	4	22	Male
9	13	5	23	Male
10	13	5	23	Female
11	13	5	23	Female
12	14	2	19	Female
13	14	4	21	Female
14	14	4	21	Male
15	14	4	21	Male
16	14	5	22	Male
17	14	5	22	Male
18	15	3	19	Male
19	15	4	20	Female
20	15	4	20	Female
21	15	4	20	Female
22	16	5	20	Male
23	16	5	20	Male
24	16	5	20	Female
25	16	6	21	Female
26	16	6	21	Male
27	16	8	23	Not known
28	17	4	18	Female
29	17	4	18	Female
30	17	4	18	Female
31	17	5	19	Female
32	17	5	19	Female
33	17	6	20	Female
34	17	6	20	Male
35	17	8	22	Female
36	17	8	22	Female
37	18	5	18	Female
38	18	5	18	Female
39	19	6	18	Female
40	19	6	18	Female
41	19	7	19	Female
42	19	7	19	Female
43	19	8	20	Female
44	19	8	20	Male
45	19	11	23	Female
46	20	5	16	Female
47	20	5	16	Female
48	20	6	17	Male
49	20	6	17	Male
50	20	7	18	Male
51	20	8	19	Female
52	20	8	19	Female
53	20	8	19	Female

RECORDS OF THE PUPAL INSTAR—*Concluded*

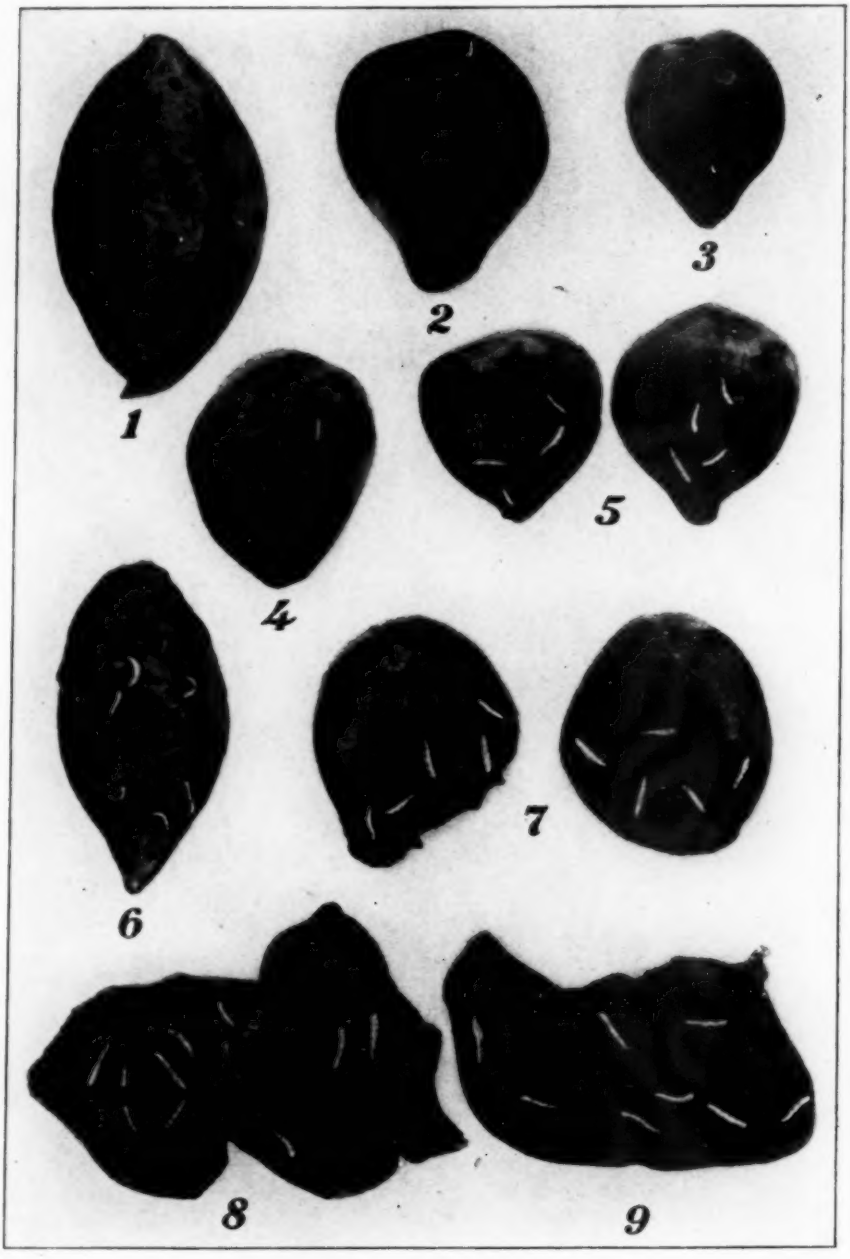
No. individual	Date of pupation	Date of adult emergence	Pupal period days	Sex of moth
54	May 20	June 10	21	Female
55	20	11	22	Male
56	20	12	22	Male
57	20	12	22	Female
58	21	8	18	Male
59	21	8	18	Male
60	21	8	18	Female
61	21	8	18	Male
62	21	10	20	Male
63	21	11	21	Male
64	21	11	21	Male
65	21	11	21	Male
66	21	11	21	Female
67	22	10	19	Female
68	22	10	19	Male
69	22	11	20	Male
70	22	11	20	Male
71	22	11	20	Female
72	22	11	20	Female
73	23	11	19	Female
74	23	12	20	Female
75	24	14	21	Female
76	27	15	19	Female
77	June 1	19	18	Female

Gillette and Weldon [4] state that the pupal stage occupies about ten days in the vicinity of Canon City, Colo.

It appears thus that the larvæ pupate on the average nearly a month earlier in California than in Colorado and that the pupal instar occupies almost double the number of days in the former state as in the latter. The first of these phenomena is to be expected when it is considered that larvæ hatch from the winter eggs much earlier in California than in Colorado, Gill [5] in his paper stating that "During the season of 1912, in the orchards, the eggs were hatching from April 20 to May 9, . . ." A comparison of the meteorological conditions influencing respectively Colorado and California pupæ might explain the difference in the length of the instar in the two localities.

[4] Gillette and Weldon, "The Fruit-tree Leaf-roller in Colorado," Colo. Agr. Exp. Sta. Circ. 5, p. 6.

[5] U. S. Dept. Agr. Bull. 116, pt. 5, p. 102.



Mediterranean Fruit Fly

THE LIFE HISTORY OF THE MEDITERRANEAN FRUIT FLY (CERATITIS CAPITATA WIED.) WITH A LIST OF FRUITS ATTACKED IN THE HAWAIIAN ISLANDS

By Henry H. P. Severin, Ph. D.

The life history of the Mediterranean fruit fly under Hawaiian conditions was worked out in the tropical almonds (*Terminalia catapa*). The tropical almond is a very common deciduous shade tree of the Hawaiian Islands and bears clusters of compressed nut-like fruits, each fruit being one to two inches long and resembling an almond (Plate 9, figure 1). The fibrous shell of the nut is covered with a thin pulp (Plate 9, figure 6) and it is this pulp that is seriously infested by the pest. The pulp of the fruit is sweet and resembles somewhat the taste of an apple.

Deposition of Eggs.—In ovipositing the Mediterranean fruit fly "stings" the fruit with its needle-like ovipositor, forming a small receptacle within which the eggs are deposited. A secretion is then poured over the eggs by the fly and this acts on the surrounding tissue, changing it into a brown gelatinous substance. This gelatinous substance often exudes out of the mouth of the receptacle and hardens. Green peaches that have been punctured by the pest show the gummy exudation (Plate 9, figure 3) more conspicuously than tropical almonds similarly affected. Green and ripe lemons may also show evidence of a resinous material which exuded from the wound produced by the ovipositor. Green oranges when "stung" often show a premature ripening around the puncture. In some unripe fruits the secretion poured into the receptacle formed by the female fly prevents further growth of the tissue in this region, and results in the formation of a depression on the surface of the fruit. (Plates 9, 10, figures 1, 2 and 10).

The number of eggs which the fruit fly deposits within the receptacle varies from 1 to 42. Five receptacles within a tropical almond contained 15, 18, 30, 33 and 42 eggs, or a total of 138 eggs. The pulp of the tropical almond and other fruits is often punctured by the ovipositor and yet no eggs are deposited.

The fruit fly is unable at times to withdraw its ovipositor from some fruits. An unripe tropical almond was found in which the distal end of an extended ovipositor was caught within the fibrous shell of the nut, while the rest of the body was missing. In all probability the missing part of the body of this specimen had been devoured by a lizard. The female fly is often unable to withdraw its ovipositor from the sticky, milky juice of the unripe star apple and dies as a result of starvation (Plate 10, figure 14).

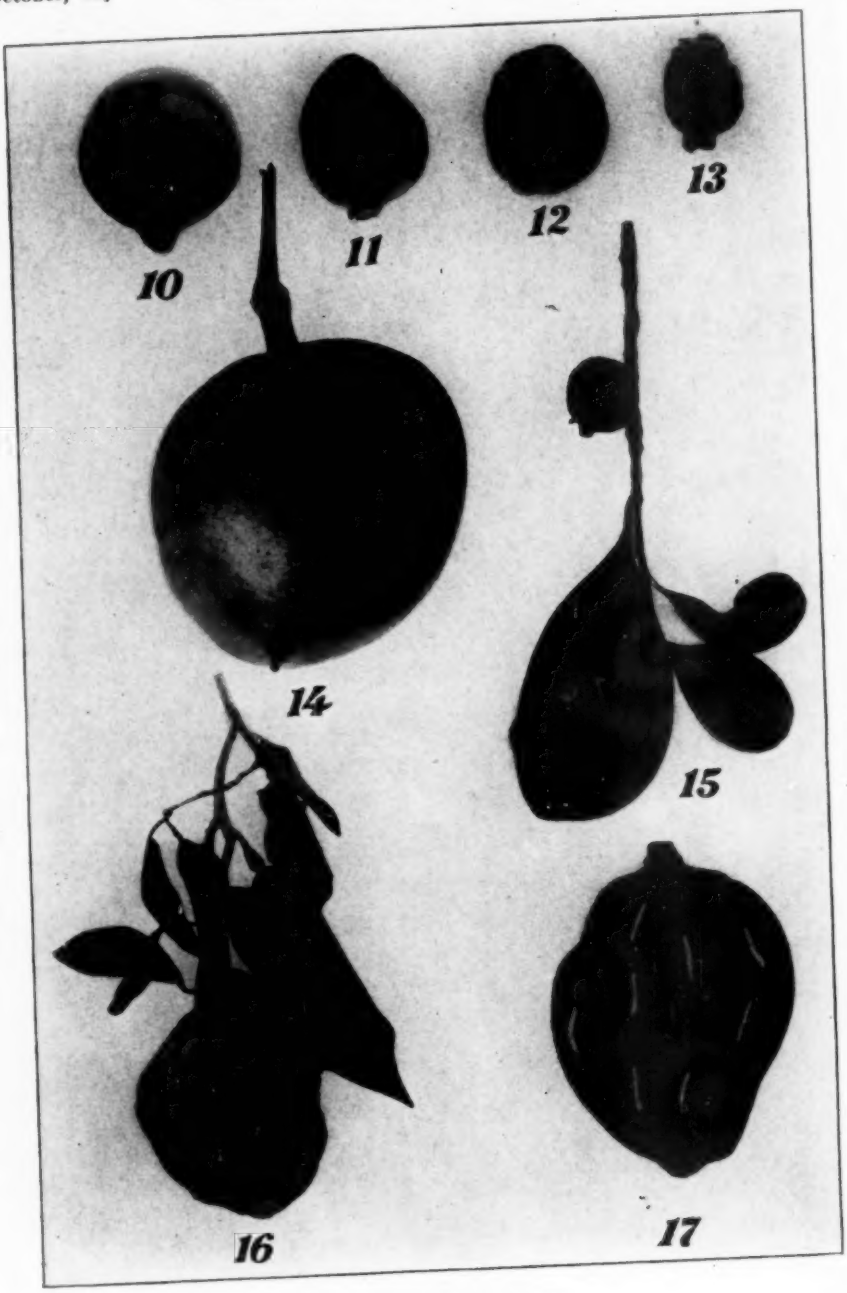
When the eggs are deposited within the pulp of ripe tropical almonds they hatch in from 2 to 3 days but when deposited in green fruits the egg period is often somewhat prolonged.

LARVÆ.—Eggs deposited in some green fruits either do not develop or the recently hatched larvæ perish apparently from the effects of the strong acid pulp of the fruit. The larvæ, however, are able to develop in unripe tropical almonds and peaches. Concerning the development of the eggs and larvæ in green Chinese bananas we (4, p. 446) found that of 100 eggs planted within the peel 69 hatched, but all of the maggots died, probably from the effects of the tannic acid. Many eggs deposited in green and ripe lemons (*Citrus medica limonum*) hatched but in our observations all of the maggots died. French (2, p. 3) of Victoria and Mally (3, p. 5) of South Africa have both, however, succeeded in breeding the Mediterranean fruit fly from lemons. Whether the maggots of this pest are able to complete their larval development in certain varieties of lemons and not in others will require further investigation.

The larvæ work their way into the pulp of the fruit, which soon begins to decay (Plate 9, figures 5, 6, 7, 8 and 9) and the fruit usually drops to the ground. On rare occasions the dried and shriveled fruit will remain adhering to the trees after all of the larvæ have burrowed out (Plate 10, figures 15 and 16). It may happen that some of the maggots will bore out of the fruit before the same drops to the ground.

The larvæ remain in the tropical almond from 8 to 17 days after which they bore out and enter the ground to pupate. The rate of development of the maggots probably depends on many factors, such as temperature, moisture, the kind, ripeness, hardness, decay, dryness, and acidity of the fruit.

Data were desired concerning the number of Mediterranean fruit fly larvæ which may be found infesting tropical almonds. Accordingly, 25 infested tropical almonds were gathered at random from a tree and placed in 25 breeding jars. In two weeks a total of 1037 fruit fly maggots had bored out of the pulp of these fruits. Each tropical almond was now immersed in water so as to drown out any larvæ which might still be present in the pulp or fibrous shell of the nut. With the addition of a small quantity of alcohol to the water the maggots leave the fruit more rapidly and within five hours 341 immature fruit fly larvæ burrowed out of the decayed pulp. The pulp of each fruit was now carefully removed and two maggots were found within the fibrous shell. The total number of full grown and immature larvæ obtained from 25 tropical almonds was 1380. The largest number of full grown maggots obtained from a single tropical almond was 98, of these 60 were full grown and 38 immature. One would be inclined to believe that



Mediterranean Fruit Fly

with so many maggots present, some would not obtain a sufficient food supply from the small amount of pulp surrounding the seed. The largest number of adult fruit flies bred from a single tropical almond was 28 males and 32 females, a total of 60 flies; some of these specimens were much smaller than others, but we did not determine whether these were able to deposit eggs.

In another experiment 12 infested tropical almonds were placed in separate breeding jars and exposed to hot sunshine. At the end of a week the pulp of these fruits became hard and leathery. From two of these fruits 19 larvæ bored out, 7 of which died in the bottom of the jars and 12 pupated, but the pupæ failed to give rise to imagoes. A field observation along this same line may be worth recording. An orange that had been exposed to hot sunshine was found on the ground and upon opening this fruit three dead Mediterranean fruit fly larvæ were found. These maggots were black or brown in color and suggested that death had been due to a bacterial or fungus disease. Mally (3, p. 10) also observed many dead larvæ in the fallen fruits of *Citrus buxifolius* and concluded that after several days of very hot weather the fruit "became sufficiently hot to destroy the contained maggots."

PUPÆ.—After the larvæ leave the fruit they bore into the ground to pupate. Rarely under normal conditions do the maggots pupate within the fruit, but a few pupæ have been found in the pulp of the tropical almond and orange. The pupal period requires from 15 to 17 days, before the adults emerge.

ADULT.—Dreyer of South Africa (1) writes: "It is well known that when the flies appear on the wing their eggs are undeveloped and require, in order to be brought to maturity and made ready for laying, a period of about 10 to 12 days during which the flies subsist on saccharine substances." An attempt was made to determine the length of this period under Hawaiian conditions. A large number of fruit flies were kept in captivity in breeding jars and fed on dilute molasses, the juice of orange, prickly pear and on water. After having been kept in captivity for 8 days, three females were dissected but no fully developed eggs were found in the ovaries. Daily dissections of three females were continued from now on and ripe eggs were found in one fly at the end of 11 days but other females did not show mature eggs in the ovaries at the end of 14 days. In all probability the effect of confining the fruit flies in breeding jars plays an important part in the rate of development of the reproductive organs.

The duration of the different stages of the life history of the Mediterranean fruit fly may be summarized as follows:

Egg period	2 to 3 days.
Larval period	8 to 17 days.
Pupal period	15 to 17 days.
Egg-laying begins	10 to 12 days after the adults emerge (Dreyer).
" "	35 to 49 days.
" "	5 to 7 weeks.

Miss L. Gulick and the writer have bred the Mediterranean fruit fly from a long list of fruits in the Hawaiian Islands. Since the common names by which these fruits are known in the Hawaiian Islands may be entirely different in other parts of the world we give in the following list not only the common names but also the scientific names of these fruits, basing the latter on the authority of G. P. Wilder's (5) work on "Fruits of the Hawaiian Islands."

1. Anona muricata (sour sop).
2. Arenga saccharifera (sugar palm).
3. Averrhoa carambola (carambola).
4. Carica papaya (papaia).
5. Carica quercifolia (baby papaia).
6. Carissa ardiuna (Natal plum).
7. Cestrum sp? (Chinese ink berry).
8. Chrysophyllum cainito (star apple).
9. Chrysophyllum oliviforme (Damson plum).
10. Citrus aurantium (Bahia, or Washington navel orange).
11. Citrus aurantium sinense (Waialua orange).
12. Citrus decumana (grapefruit).
13. Citrus japonica (kumquat).
14. Citrus japonica "hazara" (Chinese orange).
15. Citrus medica limetta (lime).
16. Citrus nobilis (Mandarin orange).
17. Coffea liberica (Liberian coffee).
18. Diospyros decandra (brown persimmon).
19. Eriobotrya japonica (loquat.).
20. Eugenia jambos (rose apple).
21. Eugenia uniflora (French cherry).
22. Ficus carica (fig).
23. Jambosa malaccensis (mountain apple).
24. Mangifera indica (mango).
25. Mimusops elengi (elengi tree).
26. Murraya exotica (mock orange).
27. Musa cavendishii (Chinese banana).
28. Noronhia emarginata (Chinese plum).
29. Opuntia tuna (prickly pear).
30. Persea gratissima (avocado or alligator pear).
31. Prunus persica (peach).
32. Psidium cattleyanum (strawberry guava).
33. Psidium guayava (sweet red guava).
34. Psidium guayava (white lemon guava).
35. Psidium guayava pomiferum (common guava).
36. Thevetia nerifolia (yellow oleanda).
37. Terminalia cattapa (tropical almond called "kamani" by the Hawaiians).
38. Vitus labrusca ("Isabella grape").

The pest has also been bred from green peppers. Squash and string beans are also said to be attacked by the insect.

A few fruits kept under observation were found to be immune from the attacks of Mediterranean fruit fly under natural conditions. The following list is by no means complete:

1. Artocarpus incisa (bread fruit).
2. Citrus medica var., limonum (rough-skin lemon).
3. Morinda citrifolia ("noni").
4. Morus nigra (mulberry).
5. Punica granatum (pomegranate).
6. Tamarindus indica (tamarind).

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EXPLANATION OF PLATE 9.

Fig. 1. Tropical almond showing depressions caused by the oviposition of the Mediterranean fruit fly.

Fig. 2. Peach showing similar depressions.

Fig. 3. Green peach showing gummy exudation which often exudes from the wound caused by the ovipositor.

Fig. 4. Peach with collapsing peel due to decay of the pulp brought about by larvæ of the Mediterranean fruit flies.

Figs. 5 and 7. Peaches cut in half showing decay and fruit fly maggots.

Fig. 6. Tropical almond with peel removed showing the Mediterranean fruit fly larvæ and thickness of pulp.

Figs. 8 and 9. Peaches broken open showing more advanced stages of decay and larvæ.

EXPLANATION OF PLATE 10.

Fig. 10. Strawberry guava showing depressions.

Figs. 11, 12, and 13. Strawberry guavas showing different stages of decay caused by the larvæ of the Mediterranean fruit flies.

Fig. 14. Dried and shriveled strawberry guava still adhering to a twig after all of the Mediterranean fruit fly larvæ have bored out. The infested fruit, however, usually drops to the ground before the maggots bore out.

Fig. 15. Unripe star apple showing dead Mediterranean fruit fly which was unable to withdraw its ovipositor from the sticky, milky juice of this fruit.

Fig. 16. Dried navel orange still adhering to the twig and showing a hole through which the fruit fly larvæ and decayed pulp dropped out. After the Mediterranean fruit fly larvæ caused this orange to decay, the black and the brown fruit beetles and their grubs and Drosphilid larvæ also infested this orange.

Fig. 17. Mango with peel removed showing decay and maggots.

NOTES ON OREGON COCCINELLIDÆ

By H. E. Ewing
Oregon Agricultural College, Corvallis, Oregon

For almost two years the writer has taken field notes on the more common species of Coccinellidæ found in Oregon. Several experiments also have been made with them in the laboratory in order to test their fecundity, the stability of varieties, and the economic value of the different forms. From these field notes and laboratory records the following account has been prepared.

Relative Economic Importance of Different Species Found in Oregon

The most abundant and the most important species of Coccinellidæ found in Oregon is *Hippodamia convergens* Guérin. It is found everywhere in the lower altitudes of western Oregon in the spring and summer, and in the higher altitudes during the fall and winter. It is found in eastern Oregon, but may not have a general distribution there.

The next most abundant and most important species found here is *Hippodamia spuria* Leconte. During the month of September, 1912, I collected a hibernating mass of this species, found in company with *H. convergens* Guérin, from the top of Mt. Chintimini (about 4000 ft.). Out of 256 individuals obtained, 64 were *H. spuria* Leconte and 192 were *H. convergens* Guérin. This is about the average ratio of the two species as found during the summer time feeding in the valley. Next in abundance, but probably not in importance is *Coccinella novemnotata* Herbst. Then comes perhaps *Chilocorus bivulnerus* Mul. and *Cycloneda sanguinea* Linn. While these two latter species are not so abundant as *Coccinella novemnotata* Herbst., their activities are directed against more serious pests. *Psyllobora tædata* Leconte appears to be the most abundant species found among the foothills and mountains in the summer. It is not of special economic importance as yet as it seldom is found in the valleys on cultivated plants. *Smilia misella* Leconte is present in the Willamette Valley, and does good work against the San Jose Scale. *Adalia bipunctata* Linn., *Hippodamia parenthesis* Say, and *Coccinella transversoguttata* Fald. are present in considerable numbers, but never are of prime importance.

Migration and Hibernation Habits

Late in July or early in August many of our most common coccinellids run short of aphid food, and for a while will be found in great

numbers feeding upon the pollen of various plants. In searching for such food, there frequently is a tendency for large numbers to move in certain directions or to collect upon certain very much desired flowers. However, there does not appear to be any fixed migration accompanied by such gregarious habits as are found for example in the case of some of the species of blister beetles, Meloidæ.

By the middle of August (which here is the hottest and dryest part of the year) the coccinellids begin a definite migration. They, almost of one accord, quit the hot dry valleys and move upward, many of them never stopping until the highest point for miles around is attained. Thus, last September I found thousands of them on the very summit of Mt. Chintimini, the highest point in the Coast Range Mountains. Here in these higher altitudes the coccinellids move about and swarm many times. As soon as winter has set in they have settled in their permanent hibernating quarters. These consist of pockets under large stones, rubbish, or under leaves or logs. There is a strong tendency for the different species and varieties to segregate themselves in their winter quarters. Thus in many pockets of *Hippodamia convergens* Guérin will be found all or over 90 per cent of the typical form, *i. e.*, the form with thirteen spots on the elytra. Other pockets will contain individuals all or the most of which are spotless forms of *H. convergens* Guérin. I have found that there is sometimes a mixing of species in the hibernating quarters, thus frequently a few individuals of *H. spuria* Leconte will be found with *H. convergens* Guérin and vice versa.

The coccinellids pass the winter without food, and are, for long periods at least, perfectly quiescent. That some of our species can pass the winter hibernating at the lower levels I have proved by experments, the mortality, however, is very great unless they are kept in artificially cooled quarters.

Emergence of Adults in Spring

There is some variation among the different species in regard to the time of emergence in the spring. At Corvallis, a valley town 230 feet above sea level, I have the following records for the spring of 1913. The dates given represent the first recorded observation of an active individual out of doors:

Chilocorus bivulnerus Muls. ..... February 10.
Hippodamia convergens Guérin (spotless form) ..... April 11.
Adalia bipunctata Linn. ..... April 14.
Hippodamia convergens Guérin (typically marked) ..... April 16.
Hippodamia convergens Guérin (with some spots) ..... April 17.

Hippodamia spuria Leconte.....April 21.
Coccinella novemnotata Hbst.....April 21.
Coccinella transversoguttata Fald.....April 21.

By the time that most of these coccinellids reach the valleys, *i. e.*, by the middle of April, an abundance of aphid food is present. Our most common aphids hatch in early March, and by the middle of April most of these individuals are mature.

However, this supply of food is cut short by about the middle of May, due not only to the voracious appetites of the lately emerged coccinellids, but to other enemies also, the most important of which are syrphis fly larvæ and a lampyrid beetle, *Podabrus prinosus* Leconte.

Again the coccinellids must rely upon plants for most of their food. By the first of June, thousands of individuals will be found in vetch fields and among wild flowers along the road sides or in turning rows. Around Corvallis, nearly all of the common species go to the vetch fields. Here they feed upon a cell sap or nectar secreted by special glands, one of which is located on each stipule situated at the base of a compound leaf.

Miscellaneous Notes and Observations

There is a distinct preference shown by our most common coccinellids for certain species of *Aphididæ*. Among those most sought are: The Black Cherry Aphis (*Myzus cerasi* Fab.), Snow-ball Aphis (*Aphis viburni* Scopoli), Rosy Apple Aphis (*Aphis sorbi* Kalt.), and European Grain Aphis (*Aphis avenæ* Fab.).

On the other hand, such aphids as the Green Apple Aphis (*Aphis pomi* DeGeer) and the Woolly Apple Aphis (*Eriosoma lanigera* Haus.) are not relished with nearly as much zest as the former mentioned plant lice. In fact some of our common coccinellids will not live alone upon a diet of *Aphis pomi* DeGeer. This I have demonstrated in the laboratory.

Among the records of some of the rarer species of coccinellids, I have to report a single observation of *Anisocalvia duodecimmaculata* Gebl., a female, and of *Anisocalvia quatuordecimguttata* Linn., a male. These two were found in copulation, on leaves of vine maple, at Corvallis, May 2, 1913, by G. Moznette.

Before closing I will add a single synonymical note. I am of the opinion that the typically marked form of *Hippodamia convergens* Guérin and the spotless form should be regarded as distinct species, as they were once, for the following reasons:

1. I find the spotless form breeds true to type.
2. The two forms have a tendency to segregate themselves in their

hibernating quarters and during their breeding season early in the spring. Thus, out of a hibernating mass collected March 9, 1913, at Sulphur Springs, Benton Co., by F. D. Bailey, containing 367 individuals, 344 were typically marked while only two were spotless. Out of 552 individuals collected at Carlton, during March, 1913, 500 were typically marked; only 5 were spotless. Out of 33 individuals found under bands on seven year old cherry trees May 15, 1913, 30 were spotless, 1 was typically marked.

3. The fact that the two are found intergenerating should not affect their specific status, for frequently intergeneration takes place in nature between different species of Coccinellidæ.

NOTES ON THE NEGATIVE GEOTROPISM OF CORYTHUCA CILIATA SAY, ADALIA BIPUNCTATA LINN, COCCINELLA 9-NOTATA HBST AND MEGILLA FUSCILABRIS MULS.

By HARRY B. WEISS, *New Brunswick, N. J.*

Corythuca ciliata Say. Upon placing hibernating specimens of this "lace bug" in a glass cage in a warm room, their re-actions to gravity were manifested in a rather curious way. When the temperature in the cage rose sufficiently, all became active and possessed of a desire to climb vertical surfaces. Small sticks placed vertically in the cage were soon covered with individuals going up and those unable to gain a foothold on the sticks, climbed upon the backs of others and made their ascent in this manner, until the sticks were covered with one seething mass of insects.

Those on the bottom of the jar re-acted somewhat differently. One individual meeting another, would climb upon its back and a third happening along would climb upon the back of the second and a fourth and fifth would do the same, until a regular tower of "lace bugs" was formed. As a rule, when the sixth attempted to climb up, the tower would sway, finally topple and all would come down. If the first happened to be resting at an angle on the edge of a piece of bark, the tower would extend out over the edge in an extremely perilous position and usually collapsed when the fourth attempted to climb out.

In most of the cases, the last one up, would fly off in the same manner that a "lady bird" walks upward on a twig, until the top is reached and then flies off, provided it finds no plant lice.

In the bottom of the cage were several pieces of bark and the insects always preferred walking on edges or ridges that pointed upward.

This negative geotropic response took place in the dark as well as in the light, provided the temperature was high enough. Rays of

light thrown upon different parts of the cage, produced no responses, the insects in all cases adhering to their geotropic re-actions.

Adalia bipunctata, Coccinella 9-notata and *Megilla fuscilabris*. In order to determine the distance over which a Coccinellid would travel during a negative geotropic response in the absence of food, specimens of *Adalia bipunctata* were taken while feeding, kept for five hours without food and then placed on the bottom of a fifteen foot vertical stick. The following table shows the distances travelled by ten different beetles. The stick was placed out of doors in the shade, the temperature being 70° F.

The length of time, from the start until they flew away was also noted and this varies considerably, many of the beetles resting for comparatively long periods.

ADALIA BIPUNCTATA LINN.

Shade, Temperature 70° F.

A	8 feet,	2 inches,	18 minutes
B	13 feet,	1 inch,	10 minutes
C	6 feet,	2 inches,	11 minutes
D	13 feet,	6 inches,	30 minutes
E	4 feet,	4 inches,	8 minutes
F	10 feet,	3 inches,	15 minutes
G	3 feet,	6 inches,	12 minutes
H	11 feet,	1 inch,	12 minutes
I	6 feet,	6 inches,	8 minutes
J	9 feet,	2 inches,	18 minutes

The average distance covered comes to a little over eight feet and in no case was the top of the stick reached.

The following table gives the distances covered by *Coccinella 9-notata*, both in the sunlight and shade.

COCCINELLA 9—NOTATA HBST.

	Sunlight, Temperature 83° F.				Shade, Temperature, 75° F.		
A	1 foot,	9 inches,	3 minutes	A	9 feet,	2 inches,	6 minutes
B		6 inches	1 minute	B	8 feet,		8 minutes
C	1 foot,	6 inches,	2 minutes	C		3 inches,	1 minute
D	1 foot,	1 inch,	3 minutes	D	11 feet,		4 minutes
E	1 foot,	4 inches,	2 minutes	E	8 feet,		7 minutes
F		10 inches,	4 minutes	F	8 feet,	9 inches,	10 minutes
G		5 inches,	2 minutes	G	8 feet,		3 minutes
H	2 feet,	9 inches,	1 minute	H	7 feet,		4 minutes

These Coccinellidæ were taken while feeding and kept two hours without food. With this species, the average distance in the sunlight is 1 foot, 3 inches and 7 feet, 6 inches in the shade.

The next table is for *Megilla fuscilabris* Muls. These individuals were also taken while feeding and kept one hour without food.

MEGILLA FUSCILABRIS MULS.

	Sunlight, Temperature 89° F.			Shade, Temperature 75° F.		
A		5 inches,	5 seconds	A	12 feet,	1 inch, 9 minutes
B		6 inches,	5 seconds	B		6 inches, 5½ minutes
C		3 inches,	4 seconds	C	17 feet,	7 minutes
D		5 inches,	4 seconds	D		4 inches, 5 seconds
E	7 feet,		2 minutes	E	8 feet,	2 inches, 8 minutes
F		3 inches,	4 seconds	F	1 foot,	7 inches, 4 minutes
G		8 inches,	3 seconds	G	9 feet,	5 minutes

The averages for this species are 1 foot, 4 inches in the sunlight and 7 feet in the shade. Individuals which had climbed three or four feet in the shade after being moved to the sunlight, continued only a few inches more and then flew off. Of the three species, *Megilla fuscilabris* was the most active, being seemingly possessed of a nervous irritability.

All of the beetles were handled as little as possible and used only once.

The tables show that the length of time and especially the distance covered, were considerably shortened when the re-actions took place in sunlight and while the temperature was higher, yet beetles moved from the shade to sunlight flew away almost before they could have become sensible to the higher temperature.

Plant lice of course are usually found in shaded situations such as the undersides of leaves and Coccinellidæ undoubtedly hunt longer and over a greater distance in such situations.

It seems fair to conclude then, that other factors being equal, sunlight and possibly high temperatures shorten the distance covered during a geotropic response and also the time during which the beetle responds to such stimuli, thereby giving the beetle a greater chance to find food. Sunlight does not, however, influence the direction of locomotion or the negative geotropic position assumed by the beetle.

NOTES ON GYPONA OCTOLINEATA SAY

(Hemiptera, Jassidæ)

By R. L. WEBSTER

Not much concerning this common leaf-hopper, sometimes known as the "eight lined Gypona," appears in entomological literature. Outside of some observations by Fitch (1867) and later by Osborn and Ball (1897), very little has been written. While of no great economic importance, this species, with other leaf-hoppers, no doubt causes considerable injury in grass lands, as suggested by Osborn and

Ball. As Fitch has said, however, the insects feed in a great variety of situations, with apparently little preference.

Occasional observations on this insect have been made by the writer in Iowa, and some new things have been learned. For that reason these notes are presented for publication, together with records of other writers, bringing so far as possible the knowledge of this species up to date. These notes are from the files of the entomological section of the Iowa Agricultural Experiment station at Ames.

PAST HISTORY. This species was first described by Say (1825), who gave it the name *Tettigonia octolineata*. Subsequently it was placed in the genus *Gypona*. Fitch (1851) described *Gypona flavilineata*, but Osborn and Ball (1897) consider that Fitch's species is only a variety of *octolineata* Say.

DISTRIBUTION. Doctor Forbes has given as the distribution of this insect: Eastern United States, Canada to Texas. Van Duzee records the variety *flavilineata* collected by W. J. Palmer near Lake Temagami, Ontario. Lugger mentions the species as occurring in Minnesota and Uhler records it in Colorado.

FOOD PLANTS. Any list of the food plants of this ubiquitous species is necessarily incomplete, on account of its adaptability to so many different plants. Fitch listed the following: Dahlia, aster, oak, walnut, beech, maple, birch, willow and dogwood. Other records are blackberry (Lugger) and sugar beet (Forbes). Osborn and Ball found that the insect "occurred upon the wild grasses of woodlands especially." In the insectary at Ames the nymphs and adults lived on apple shoots readily.

LIFE HISTORY. *Generations.* Osborn and Ball (1897) have shown that there are in Iowa two generations of this insect. In 1909 in the insectary two generations were observed, for second brood nymphs were reared from eggs deposited by first brood adults. The insect winters in the egg stage and the eggs are placed singly in small pouches in the bark of apple and probably of other trees.

Osborn and Ball said that the first brood nymphs (half to full grown) were abundant in Iowa from mid-June to mid-July; the adults from the first of July to the middle of August. The writer's records are generally earlier than these dates. Practically all of the notes of the writer refer to the first generation.

According to Osborn and Ball the second brood larvæ appear in late August and September; the adults in September and October.

The adults of the first generation are of the *flavilineata* type, while those of the second are usually of the *octolineata* type, according to the observations of Osborn and Ball. The adults (all first brood) reared in the insectary by the writer, were all of the *flavilineata* type.

The Egg. Eggs of this species were found deposited in the bark of young apple trees, as the following notes from insectary records show.

In the spring of 1909 a number of young Jonathan apple trees, sent from Shenandoah, Iowa, were set out in the insectary for experimental use. In the bark of one of these trees were two egg pouches, similar to those figured by Riley (1892) as egg pouches of the Membracid, *Ceresa taurina* Fitch. These two eggs hatched, but the nymphs were overlooked until May 31, when they were over half grown. Some of these same nymphs were found on other young Jonathan trees in the insectary at this time. The two nymphs from the one tree were kept in a separate cage on a young apple tree, and on June 9 they became adult. The two happened to be male and female, and were found in copulation at this time. The species was then determined as *Gypona octolineata*, variety *flavilineata*.

On June 15 in this cage I found a single egg deposited openly on a leaf, and also a number of egg slits in the bark of the young apple tree. The single egg in the open was apparently accidentally deposited there. This egg was cylindrical, white, 1.63 mm. long and .32 mm. broad. One end of the egg was slightly more rotund that the other, which tapered a little more.

These egg slits were, of course, similar to those in the apple bark from which the parent Jassids had come. On subsequent days in this cage more eggs were deposited, until 34 in all were counted in the bark. These eggs were placed usually at random over the bark; in one instance four were placed in a row, one below the other, and slightly to the left. These last apparently were deposited at one time.

On July 3, 18 days after the eggs were first seen, the young nymphs appeared in this cage. These nymphs lived for about two weeks, but finally all of them died, apparently having been killed by some spiders that had gotten into the cage.

At Shenandoah in the spring of 1908, and again in 1909, I noticed egg pouches similar to those described above, in apple nursery stock in some abundance. This was in the same nursery from which the young Jonathan trees, previously mentioned, had come. The same kind of eggs were also common on Carolina poplar nursery trees, where from 6 to 12 punctures in a row were often found, although from 6 to 9 was the usual number.

These eggs found at Shenandoah were like those deposited in the apple bark in the insectary, except that there was a black mark present on the egg at the slit. This mark shows on the egg itself, after being dissected from the bark, as well as through the slit in its normal position. In the eggs deposited in the insectary cage in June, these black

marks were not found. I think, however, that both kinds were made by the same species.

Twice I have run across eggs of this kind in the skin of apples, once in 1908 and again in 1909. In 1909 (Journ. Econ. Ent.) I described the eggs found the fall before, referring them doubtfully to *Ceresa taurina* Fitch. The work of Hodgkiss (1910), however, has shown that the eggs of *Ceresa taurina* are placed in a quite different situation, and my more recent observations show that the eggs of *Gypona octolineata* are similar to, and probably the same as, the eggs found in the skin of the apple.

No blackened portion of the egg is mentioned in my notes of November, 1908, but in November, 1909, when similar eggs were found in a Ben Davis apple, the black mark on the egg at the slit was quite distinct.

Jassid eggs of this description have been referred to two species of Membracids, first to *Ceresa bubalus* Fabr., by Riley (1873) and later by the same writer (1892) to *Ceresa taurina* Fitch. Hodgkiss (1910) has shown that the eggs of *Ceresa taurina* are deposited in the buds of apple trees, and refers the egg pouches figured by Riley to some of the large leaf-hoppers, naming *Gypona cana* Burm., and *Gypona octolineata* Say.

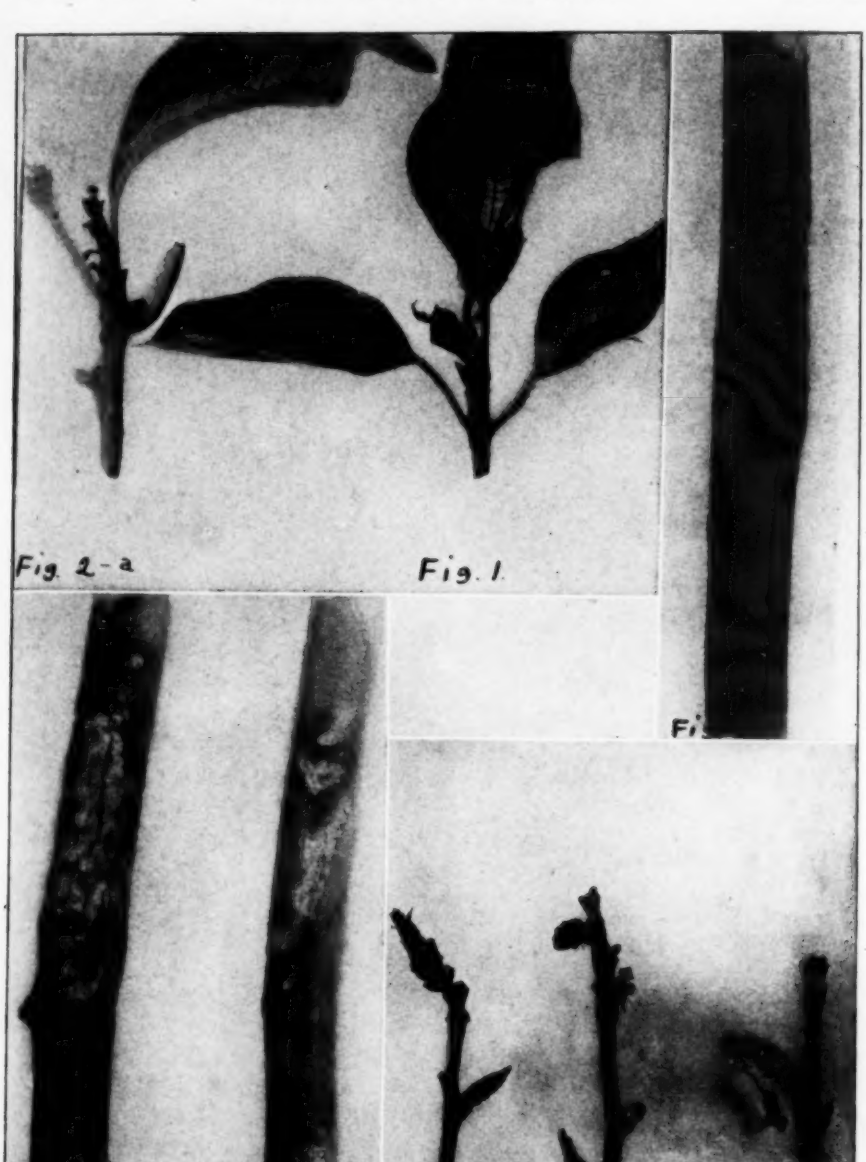
An excellent illustration of these eggs may be found in the *Pennsylvania Zoölogical Bulletin*, vol. 5. No. 3. plate ix., drawn by W. R. Walton. Here the eggs are wrongly referred to *Ceresa bubalus*, in spite of Riley's later correction (1892).

The Nymphs. I have twice observed nymphs hatching from eggs which were probably of this species. At any rate I could not distinguish any differences that would separate them. At Shenandoah May 10, 1909, I found a nymph just emerging from an egg deposited in the bark of a Carolina poplar tree. Again at Burlington, Iowa, April 15, 1910 (a very early spring) I found a nymph emerging from an egg placed in the bark of a crabapple tree. These nymphs were both pale orange in color, with long antennæ, reaching beyond the tip of the abdomen. They were also pale along the median dorsal line.

The following description of the larva is taken from Osborn and Ball. "The larvæ very strongly resemble the adults. The head is abruptly narrowed in front of the eyes but projected centrally. The antennæ are very long, the basal joint nearly as long as the vertex, while the bristle reaches to the middle of the abdomen. The abdomen is long, rather slender, color green."

In the insectary cages the larvæ were found usually feeding along the green stems of apple twigs, or in the axils of the leaves.

The Adults. I can add nothing to previous accounts concerning the adult insects.



Work of Cryptothrips on Orange

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AN UNUSUAL TYPE OF INJURY DUE TO A THRIPS

By J. R. Watson, *Gainesville, Fla.*

In the Entomological News for February, 1912, the writer described an apparently new species of thrips (*Cryptothrips floridensis*), which was attacking camphor trees on the extensive plantation of the Satsuma Company at Satsuma, Florida. Since then some additional studies and a personal inspection of the work of the insect in the field have been made. These studies have discovered a type of injury so unusual for a thrip as to suggest that it might not be without interest to the readers of the Journal of Economic Entomology.

In the beginning of the infestation of the camphor tree, the eggs are laid between the scales of the terminal bud. If the bud has commenced to develop when the eggs hatch, the larvæ first attack the new growth. If there are but a few of the larvæ on each bud, there will result a blackening and deforming of one side of the young leaves (Plate 11, figure 1). If there are more of the larvæ, the developing bud will be killed outright, (Plate 11, figure 2). The insects then attack the younger twigs where they feed in groups, the yellow larvæ

being very conspicuous on the light green shoots of the camphor. The bark where these groups of larvæ feed is killed (Plate 11, figure 3), and, as it dries out, it cracks (Plate 11, figure 4). The adults use these cracks as hiding places and as a means of entrance to the cambium on which they lay their eggs. As the infestation proceeds the bark on all of the twigs is killed and the leaves are shed. This leaves the cambium as the only suitable breeding place, and here the larvæ as well as the adults are to be found. A favorite feeding place is at the base of a branch. This is quickly killed and then easily broken off, leaving a scar much like the one at the base of a petiole only larger and deeper (Plate 11, figure 5). They also gain access to the cambium at the cut ends of the twigs after the trees have been pruned to supply material for distillation. The Cryptothrips continue to work on the cambium until the whole plant is killed. The insect seems to be incapable of flight, although it has well developed wings. It probably spreads from one plant to another by means of workmen and horses which brush against the plants during cultivation, and by crawling over the ground, leastwise it spreads in all directions from the center of infestation, but most readily along the rows, where the distance between the plants is less than that across the rows. It kills every plant in its onward march, although it may temporarily skip one to attack those beyond.

It was found on large trees at Satsuma, near Palatka, and at Tampa, but seems to do very little harm to them. It is the young seedlings in the nursery row and the young trees in the field that are killed. The writer has been unable to find this insect about Jacksonville, Gainesville, or other towns in north Florida. This raises the question of its origin. The camphor is not a native of Florida. Is this insect a native species which has spread to the camphor, or has it been imported with camphor? The writer will be very grateful if entomologists located where the camphor trees grow will send him specimens of any black (larval yellow) thrips found on this tree.

Tobacco decoctions kill them, but it has been found necessary to make them stronger than for most species. For the adults a solution composed of a half gallon of whale oil soap, one half gallon of commercial lime sulphur, and a half pound of Black Leaf 40 to fifty gallons of water is now in use. This has proven quite efficient. It does not, however, kill the eggs and of course all the adults and larvæ hidden under the bark escape. By spraying not later than the stage represented in figure 3 when the larvæ are mostly in the buds or on the outside of the twigs, and by cutting out the trees in the later stages of infestation, it was found possible to control this pest.

THE GASOLINE TORCH TREATMENT OF DATE PALM SCALES

By R. H. FORBES, *Director, Arizona Experiment Station*

Date palms imported from the Old World into Arizona during the past 23 years have been found generally infested with two scale insects, *Parlatoria blanchardi* and *Phœnicococcus marlatti*, commonly known as the Parlatoria and the Marlatt scales. These two scales are very highly specialized in their food habits, subsisting so far as yet known only upon the date palm.

Parlatoria blanchardi infests the outer parts of the tree, including leaf stalks, foliage and fruit. *Phœnicococcus marlatti*, however, shuns exposed situations and is found deeply buried between the overlapping bases of the leaf stalks, only rarely appearing where the insects may be seen without digging into the tree. Occasionally, also, the Marlatt scale may be found upon partially exposed date palm roots.

In devising a method for the extermination of *Parlatoria blanchardi* several years ago the writer, guided by his observation of the Mexican practice of burning date palms to clear them of dead foliage, drenched the trunks of a number of palms with gasoline and set fire to them. The gasoline blast torch was afterwards found to be much more effective, penetrating inward and downward into the spaces between the leaf bases and thus reaching and exterminating the Parlatoria scale. This method has been in use in the Salt River Valley for the last eight years and this treatment, combined with judicious pruning of the older foliage of infested palms, has been found to accomplish the control of *Parlatoria* thoroughly and economically.

The Marlatt scale, however, by reason of its deep seated location in the date palm is not reached and exterminated by a treatment which suffices for *Parlatoria*. However, by cutting the old leaf stubs of the palm clear down to the bole of the tree, thus largely removing infestations of the Marlatt scale, and by then thoroughly burning the exposed bole of the tree with the gasoline torch, this scale may be entirely removed.

The old Egyptian palms on the Experiment Station Farm near Phoenix, Arizona, thus thoroughly pruned down to the boles and burned in 1906, are found at this time (1913) to be entirely free from Parlatoria and Marlatt scales. On the basis of these observations the following treatment of infested date palms is recommended, and has been adopted by the Arizona Commission of Agriculture and Horticulture: Destroy *Parlatoria blanchardi* on infested date palms and

their attached suckers by pruning and burning with the gasoline blast torch, as described in Bulletin 56 of the Arizona Agricultural Experiment Station. A year after such treatment, if the tree appears to have been successfully treated, as has proved the case with 90 per cent of those burned in Arizona, the suckers may be cut and transplanted, still infested, however, with Marlatt scale.

When the old tree has ceased bearing suckers it becomes practicable to clean the bole and burn it more thoroughly to eradicate Marlatt scale, the tree or orchard of trees being thus finally freed from both infestations. Transplanted suckers, which at the time of cutting could not have borne the severe burning necessary to deprive them of Marlatt scale, can be followed up in the same way and finally freed of infestation.

SOME RECENT MANUALS OF PARASITOLOGY

By Wm. A. Riley

As a rule the economic entomologist is expected to pass upon all questions of parasitology, whether they relate to insects or other forms. The recently awakened interest in medical entomology has made it more imperative than ever that the student planning to go into work in economic entomology should have a good basis in general parasitology. In this connection, the question as to reliable, up-to-date reference-books and compendia is one that frequently arises, and it has seemed that a brief discussion of some of the available texts, with special reference to the latest, would be of help.

Few of the branches of biological science have made more rapid progress during the past few years than has parasitology, and books which were standard until recently, are no longer satisfactory reference books for even those who are not primarily interested in this field. This is especially true of the very phases of the subject which are most intimately connected with the entomological work.

Leuckart's great classic, "Die menschlichen Parasiten," will never lose its value as a discussion of the biological principles underlying parasitism, but it was written years before the pioneer work on the relations between arthropods and parasitic protozoa were suspected and even the discussion of the vermiform parasites is superseded. Moreover, it is long since out of print and the English translation, by Hoyle, is now seldom offered. The work is of such fundamental value that any opportunity to obtain a copy should be seized.

Of the works on this subject of a more economic bearing, none has been more widely cited and quoted in this country than has Railliet's

"Traité de zoölogie médicale et agricole." Many of its eight hundred and ninety-two figures, largely original, have been used so frequently that the source of them is forgotten. Another French text, well known through its English translation by Fleming, is Neumann's "Parasites and Parasitic Diseases of Domesticated Animals." It is of value as a reference book, but is very much out of date, and the English translation contains many careless errors.

Of the books which might be listed as modern, one of the best-known is Braun's "Tierische Parasiten des Menschen," of which the fourth edition appeared in 1908. This edition was thoroughly revised and brought up to date. The English translation, by Pauline Falcke, is of the third edition, with considerable revision by Sambon and Theobald.

A very suggestive little volume is Braun and Lühe's "Handbook of Practical Parasitology," translated by Linda Forster, (Wm. Wood & Co). The discussion of sources of material and of the technique of examining and preserving parasites of all kinds, makes this book one which should be in every laboratory of zoölogy. Its consideration of the Protozoa is especially detailed.

In the line of general text-books of parasitology, the French seem to be able to maintain their supremacy. Of several recent books along this line we shall cite three which seem especially serviceable.

E. Brumpt's "Précis de parasitologie," which appeared in 1910, (Masson & Cie. 12 fr.), is an octavo volume of over 900 pages, with 683 text figures, many original, and four colored plates. Though written primarily for medical students and practitioners, it is one of the best available texts of human parasitology.

Of the same type, though not quite so recent, is Neveu-Lemaire's "Précis de parasitologie humaine," (Rudeval. 8 fr.), of which the fourth edition, greatly revised, appeared in 1908.

Of a much more general nature, and the most recent comprehensive compendium, is Neveu-Lemaire's "Parasitologie des animaux domestiques," (Lamarre & Cie., 1912; 16 fr.). In a volume of 1252 pages, richly illustrated, the author has brought together, coördinated, and presented in a clear and concise manner the latest work in his field. Not only the parasitic animals, but also the plant forms, exclusive of bacteria, are treated, though the part devoted to them covers only 182 pages. In each part, the parasites are studied in their systematic order and, following each, its pathogenic role, treatment, and especially, prophylaxis, are considered. A feature which makes it especially valuable to the non-technical worker is that, at the end of each important discussion are presented in a concise form, the most simple procedure for microscopic diagnosis. At the end of the text there are

about fifty pages devoted to a list of domestic animals and their parasites, arranged according to the organ infested. A brief bibliography and a very complete index add to the convenience of the volume.

During the past year there has also appeared a general text-book of parasitology in German: Fiebiger's "Die tierischen Parasiten der Haus- und Nutztiere," (Braumüller. 1912; 17 Marks). It is fully illustrated, an unusual proportion of the figures being original. Like the preceding, it closes with an extensive list of parasites of domestic animals, but this is far from complete. The author has treated the subject more fully from the zoölogical viewpoint and while the book has much to commend it as a text, it is less satisfactory for reference purposes than is Neveu-Lemaire's.

While this review has to do primarily with general treatises, the reader should not overlook the fact that there is appearing a large amount of important research, in the form of briefer papers, in this country. The studies of Dr. Stiles and Dr. Ransom, and their coworkers in the Public Health Service and in the Bureau of Animal Industry, and the work of Dr. Ward and his students have not only added much original material but have done much to stimulate interest in the subject in this country.

AN IMPORTANT MEANS OF PROMOTING APICULTURE: THE BEEKEEPING DEPARTMENT OF THE CONNECTICUT FAIR

By Burton E. Gates, *Amherst, Mass.*

Apiculture, as a subject of instruction, is making rapid strides among the agricultural colleges. The majority of states are furthering the industry by the enactment and administration of laws to prevent and suppress infectious bee diseases. A further effort to promote bee-keeping comes forth in competitive displays at agricultural and other fairs. Thus far, however, these displays have been relatively meager and often without particular purpose. Not infrequently the products of the apiary are displayed as an adjunct to the floral or horticultural exhibits at fairs. It is unusual for the beekeeping section to occupy a separate building and to offer awards of premiums aggregating $500.00 as at the Hartford (Conn.) Fair.

The competitive display at Hartford is under the direction of the Connecticut Beekeepers' Association, which offers premiums and conducts the displays through its Chairman, Mr. A. W. Yates. Three-fifths of the premium money are available through a state grant and

two-fifths are provided by the Fair management. The management also provides a building 75 x 50 feet, well lighted and equipped with tables. So excellent are the displays that the management regards the beekeeping show as much a feature as the poultry or floral sections.

The premiums offered are large in comparison to similar premiums at other fairs. For instance, for the largest and most attractive display of honey, the first premium is $24.00, the second, $16.00 and third, $8.00. Liberal premiums are also offered for queen rearing outfits, being $16.00, $10.00 and $6.00 respectively. With these seemingly large awards, sufficient interest is aroused among the beekeepers to cause keen competition. One of the exhibitors this year realized $130.00 on premiums.

The benefits to beekeeping derived are, the results of keen competition wherein the beekeeper makes supreme effort to produce the finest sections of honey, to grade them with the utmost discretion, to clean the sections a little better than his competitor, and to pack them in the most attractive form which he can devise. In this way the methods and interest in producing and marketing honey cannot help but be improved. On the other hand, the consumer is enlightened concerning honey. One who is skeptical can satisfy himself that he is procuring the best of pure honey at the fair. He learns to know honey in the open market and acquires a taste for this most wholesome sweet. Furthermore, the public learns that honey differs,—it may be comb, extracted or candied,—and how to use it, for the Fair displays an assortment of culinary products in which honey is used.

The general beekeeper is not without benefit, also, for a most remarkable display of bees is made. In 1913, approximately fifty colonies of different races were on exhibition, and the beekeepers could be seen inspecting the superiority of the premium stock. This collection of bees, without doubt, represented the most choice material available in the country.

Novice beekeepers and the public are afforded opportunities to learn fundamental manipulations of bees, how to handle them so as to avoid stings, to know the features and construction of hives, and to see the brood, the internal features of the colony, through the numerous demonstrations given in the wire cloth-cage by experienced experts. Those who witness such demonstrations, realize how fascinating they are and what crowds are attracted.

From the educational standpoint, furthermore, a relatively unique feature of the Connecticut display is the Section entitled "Competition for Novices," in which it is prescribed that "no one previously exhibiting or receiving premiums shall be considered in this Department." It is at once apparent what this provision affords to the new

beekeepers. While it does not prevent the novice or new beekeeper from competing in other departments, it does afford him an opportunity to display his products and to feel that he has some chance to win a premium in fair competition with similar novices. This wholesome competition, too, encourages the beginner beekeeper to enter the larger competitions in succeeding years. Such a provision in the premium list for any fair is highly commendable.

Beside the strictly competitive displays, space is provided for concessioners who have honey in all its forms, wax, and honey-sandwiches for sale. Those who have charge of the Connecticut Fair, inform the writer that this is an exceedingly important provision, being profitable not only for the concessioners, but also for the management. It is explained that the concessions attract a certain class of people who might not otherwise enter the pavilion. Moreover, it is a means of income to the beekeepers.

Combining these several features of the carefully selected schedule, liberal premiums, an attractive and ample building, classes for the professional and novice, concessions where products are for sale, and the public demonstrations of living bees, presents a most remarkable beekeeping show. Furthermore, the attendance at this Fair probably exceeded several hundred thousand. For the beekeepers, therefore, it cannot help but be a most wholesome stimulus, and a wise method of promoting interests in bees and their products among the people at large.

NEW SPECIES OF MAPLE MITES

By H. E. Hodgkiss, *Geneva, N. Y.*

A systematic study of the Eriophyidæ subsisting on maples has shown the existence of a greater variety of forms than have heretofore been known to occur on these trees. Four species of the mites have been mentioned as inhabiting maples in this country, which are included in the genera Phyllocoptes and Oxypleurites.[1] In our later studies individuals have been discovered which belong in the genera Eriophyes and Anthocoptes, the last-named genus not before being known to occur in North America. The species which have not previously been described may be recognized by the following general characters:

Anthocoptes transitionalis sp. nov. The body is very large with a broad, beak-shaped thoracic shield which projects abruptly downward over the rostrum. The dorsum is highly arched and the striæ are 21 in number, of which the anterior eight

[1] Jour. Econ. Ent. 1:311–313. 1908.

are very long and have a distinct lateral lobe. The ventral striæ are 68 or 70 in number and are coarsely punctuated. The accessory setæ are absent. The legs are long and somewhat slender. The claw is knobbed and much longer than the feathered hair, which is 5-rayed. Length of females, 240 microns; length of males, 230 microns.

Described from individuals taken from a deformed or "pustular" area in smooth bark of the red maple, *Acer rubrum* L.

Eriophyes confusus sp. nov. The body is long and tapering, with a broadly flattened thoracic shield. The striæ are 65 to 70 in number and finely punctuated. The setæ are all present. The legs are long and slender. The claw is knobbed and longer than the feathered hair which is 3-rayed. Length of females, 190 microns; length of males, 150 microns.

Described from individuals found associated with *P. quadripes* Shimer in bladder galls on the leaves of the soft maple, *Acer saccharinum* L.

Eriophyes elongatus sp. nov. The body is long and narrow with a small thoracic shield. The striæ are 70 in number and coarsely punctuated. The setæ are all present. The legs are of medium size. The claw is truncate and longer than the feathered hair which is 4-rayed. Length of females, 216 microns; length of males, 150 microns.

Described from individuals found among red erineum galls on the upper surfaces of leaves of the sugar maple, *Acer saccharum* L.

Eriophyes maculatus sp. nov. The body is long, narrow and the posterior third is gently acuminate. The striæ are 58 in number and coarsely punctuated. The setæ are all present. The legs are short. The claw is truncate and longer than the feathered hair which is 5-rayed. Length of females, 216 microns; length of males, 150 microns.

Described from individuals found among red erineum galls on the upper surfaces of leaves of the sugar maple, *Acer saccharum* L.

Eriophyes major sp. nov. The body is very long, tapering and the thoracic shield is of medium size. The striæ are 70 in number and coarsely punctuated. The setæ are all present. The legs are of medium length. The claw is knobbed and slightly longer than the feathered hair which is 4-rayed. Length of females, 212 microns; length of males, 206 microns.

Described from individuals found among galls of pinkish erineum on the under surfaces of leaves of the red maple, *Acer rubrum* L.

Eriophyes modestus sp. nov. The body is of medium length and width, with a small semi-circular shield. The striæ are 76 in number and are coarsely punctuated along the posterior margins. The coxal setæ I are indistinct; ventral setæ II and the accessory setæ are absent. The legs are of medium size. The claw is knobbed and longer than the feathered hair which is 4-rayed. Length of females, 176 microns.

Described from individuals found among greenish erineum galls on the under surfaces of leaves of the sugar maple, *Acer saccharum* L.,

collected at Bug Lake, Adirondack Mountains, N. Y., by Prof. F. C. Stewart.

Eriophyes negundi sp. nov. The body is very long, tapering, and the thoracic shield is small. The striæ are 70 in number and coarsely punctuated near the caudal margin. The setæ are all present. The legs are of medium length and slender. The claw is knobbed and longer than the feathered hair which is 4-rayed. Length of females, 220 microns; length of males, 200 microns.

Described from individuals found in wart-like swellings of leaves of the black maple, *Acer negundo* L.

Eriophyes ornatus sp. nov. The body is rather long and cylindrical. The thoracic shield is broad and narrow with a distinct geometrical sculpture. The striæ are 62 or 63 in number and coarsely punctuated. The setæ are all present. The legs are of medium length and slender. The claw is knobbed and slightly longer than the feathered hair, which is 4-rayed. Length of females, 187 microns; length of males, 173 microns.

Described from individuals found among pinkish erineum galls on the under surfaces of leaves of the red maple, *Acer rubrum* L.

Eriophyes parallelus sp. nov. The body is of medium size with a small semi-circular shield. The striæ are 54 in number and coarsely punctuated. The setæ are all present. The legs are rather long and slender. The claw is truncate and longer than the feathered hair which is 4-rayed. Length of females, 150 microns; length of males, 145 microns.

Described from individuals found in a whitish erineum on the under surfaces of leaves of the mountain maple, *Acer spicatum* L., collected by Prof. F. C. Stewart at Seventh Lake, Adirondack Mountains, New York.

Eriophyes regulus sp. nov. Body of medium size with a small semi-circular thoracic shield. The striæ are 70 in number and are finely punctuated. The setæ are all present. The legs are of medium size. The claw is truncate and shorter than the feathered hair which is 4-rayed. Length of females, 173 microns; length of males, 120 microns.

Described from individuals found among red erineum galls on the upper surfaces of leaves of the sugar maple, *Acer saccharum* L.

Oxypleurites dentatus sp. nov. The body is of medium length with a broad hemispherical thoracic shield. The dorsum is arched. The dorsal striæ are 23 in number and the lateral margins of the 14 anterior striæ are broadly and sharply serrate; the remainder are narrower with rounded margins. The ventral striæ are 80 in number and finely punctuated along the posterior margin. The accessory setæ are wanting. The legs are short and slender. The claw is knobbed and longer than the feathered hair which is 3-rayed. Length of females, 180 microns; length of males, 120 microns.

Described from individuals found on leaves, especially the under surfaces, of the Norway maple, *Acer platanoides* L.

Oxypleurites dentilobis sp. nov. The body is small, triangular and the lateral margins are bluntly serrate. The thoracic shield is large, ridged, and projects over the rostrum. The dorsal striæ are 23 in number and are ridged along the median. The ventral striæ are 63 in number, slightly swollen along the median and finely punctuated on the posterior margins. The accessory setæ are wanting. The legs are short and stout. The claw is knobbed and longer than the feathered hair which is 3-rayed. Length of females, 176–180 microns; length of males, 170 microns.

Described from individuals found on leaves of the sugar maple, *Acer saccharum* L., in association with *E. elongatus* and *E. maculatus*.

Phyllocoptes brevisetosus sp. nov. The body is very short and narrow, and has a large triangular thoracic shield which projects over the rostrum. The dorsal striæ are 18 in number, very long and ridged at the median. The ventrum is somewhat swollen anteriorly and the striæ, which number 75, are finely punctuated on the posterior margin. The coxal and ventral setæ are very short and the accessory setæ are wanting. Length of females, 180 microns; length of males, 120 microns.

Described from individuals found on leaves of the black maple, *Acer negundo* L.

Phyllocoptes constrictus sp. nov. The body is large, much distended anteriorly and abruptly acuminate caudad. The thoracic shield is very large, arched and projects over the rostrum. The dorsal striæ are 65 in number and smooth. The ventral striæ are about 110 in number and fine punctuations occur in the middle of the striæ. The accessory setæ are absent. The legs are long and stout. The claw is knobbed and longer than the feathered hair which is 6-rayed. Length of females, 183 microns; length of males, 146 microns.

Described from individuals found among red erineum galls on the upper surfaces of leaves of the sugar maple, *Acer saccharum* L.

Phyllocoptes magnificus sp. nov. The body is very large, much swollen and has a very large hemispherical thoracic shield. The dorsal striæ are 42 in number. The striæ on the ventrum are 75 in number and rather coarsely punctuated. The setæ are all present and are long. The legs are very long and stout. The claw is knobbed and longer than the feathered hair which is 6-rayed. Length of females, 207 microns; length of males, 180 microns.

Described from individuals found in epidermal hairy growths which occur in the axils of the veins on the under surfaces of leaves of the Norway maple, *Acer platanoides* L.

Phyllocoptes minutissimus sp. nov. The body is very small and tapers caudad. The thoracic shield is large and broadly flattened at the anterior margin. The dorsal striæ are 28 or 29 in number. The ventral striæ are 53 or 54 in number and coarsely punctuated. The setæ are all present. The legs are short. The claw is knobbed and longer than the feathered hair which is 3-rayed. Length of females, 110 microns; length of males, 103 microns.

Described from individuals found among red erineum galls on the upper surfaces of leaves of the red maple, *Acer rubrum* L.

Phyllocoptes quinquilobus sp. nov. The body is of medium size. The posterior margin of the thoracic shield is five lobed. The dorsal striæ are 35 in number and smooth. The ventral striæ are 68 in number and are finely punctuated. The setæ are all present. The legs are of medium length and slender. The claw is knobbed and somewhat longer than the feathered hair which is 4-rayed. Length of females, 170 microns; length of males, 150 microns.

Described from individuals found among pinkish erineum galls on the under surfaces of leaves of the red maple, *Acer rubrum* L.

Phyllocoptes splendidus sp. nov. The body is very large and the margins are strongly curved. The thoracic shield is very large, with the lateral margins converging abruptly forward. The dorsal striæ are about 60 in number and coarsely punctuated. The ventrum is swollen and the striæ, which are 85 or 86 in number, are finely punctuated. The accessory setæ are wanting. The legs are long and slender. The claw is truncate and the feathered hair is 5-rayed. Length of females, 220 microns; length of males, 216 microns.

Described from individuals found associated with *E. negundi* on leaves of the black maple, *Acer negundo* L.

Phyllocoptes trilobis sp. nov. The body is long and tapering with a large triangular thoracic shield, the posterior margin of which has three broad lobes. The dorsal striæ are 23 in number. The ventrum has 68 finely punctuated striæ. The accessory setæ are wanting. The legs are long and stout. The claw is knobbed and much longer than the feathered hair which is 4-rayed. Length of females, 200 microns; length of males, 180 microns.

Described from individuals found on leaves of the Norway maple, *Acer platanoides* L.

Phyllocoptes variabilis sp. nov. The body is of medium size, broadest behind the shield and gently acuminate to anal lobes. The thoracic shield is large, triangular and projects bluntly above the rostrum. The dorsal striæ are about 32 in number and smooth. The ventral striæ are 62 in number and finely punctuated along the posterior margin. The setæ are all present. The legs are of medium size. The claw is knobbed and somewhat longer than the feathered hair which is 4-rayed. Length of females, 180 microns; length of males, 150 microns.

Described from individuals found among red erineum galls on the upper surfaces of leaves of the sugar maple, *Acer saccharum* L.

An Eriococcus on Eriogonum. On July 14, Mr. E. Bethel found a species of *Eriogonum* at Lake Eldora, Colorado, swarming with a small mealy-bug, and sent a quantity to me alive. On examination the species proves to be *Eriococcus borealis* Ckll., having the characteristic antennæ (7-jointed in this material), denticle on claw, etc. In some cases the tarsus is as long as the tibia. The living insects, prior to the formation of the sac, are very pale creamy white, with the sides of the body conspicuously hairy. T. D. A. COCKERELL.

Scientific Notes

A Leaf-Cutting Bee from Arizona. In JOURNAL OF ECONOMIC ENTOMOLOGY, April 1913, p. 195, Mr. A. W. Morrill called attention to the injury done by bees of the genus *Megachile* in Arizona. More recently he has sent specimens which he received from Salome, Arizona, to Mr. J. C. Crawford, who has forwarded them to me for identification. They were collected at Salome, May 20, 1913, and were said to be quite destructive. The species proves to be *M. lippiæ*, differing a little from the New Mexico type in the pale hair of the ventral scope being clear white, instead of somewhat yellowish. As *M. lippiæ* was originally described as a variety of *M. cleomis*, with only comparative notes, it may be well to publish a description which will enable it to be recognized by those who have no *M. cleomis*. In general, the females look like those of *M. addenda* and *generosa* (of which *cleomis* is a subspecies), but when the abdomen is seen from above, only the last two segments show black at sides in *lippiæ*, while in the others mentioned segments 2 to 6 show black.

Megachile lippiæ (Cockerell). Female, length about 14 mm.; moderately robust, the abdomen not parallel-sided; black with the pubescence nearly all white, but some black on vertex, mesothorax and scutellum, on subapical margin and extreme sides of fifth abdominal segment, at sides of sixth segment, and on last ventral segment except basally; head very broad, the large reddish-brown eyes diverging above, the lunar orbits above conspicuously concave; face with much white hair, very dense and spreading at sides; mandibles broad, quadridentate, but the innermost tooth little developed; lower margin of clypeus quite simple; clypeus shining but well punctured; flagellum marked with dark red beneath; mesothorax not very hairy, and wholly without white lines of hair in front, its greater part closely and finely punctured, but the posterior middle with more separated punctures and in the Arizona form somewhat shining; tegulæ rufopiceous, the margins lighter; wings hyaline, broadly dusky on apical margin; legs with white hair, that on inner side of basitarsi pale orange, and on small joints of tarsi coppery-tinted; hind basitarsi moderately broadened; abdomen shining, finely punctured, with narrow white hair-bands; last dorsal segment nearly straight in lateral profile, pruinose, with fine short greyish-white hair, but at sides with long erect black hair.

T. D. A. COCKERELL.

A Parasite of the Chinch Bug Egg. In the experiments conducted this year to determine the time of the first appearance of young chinch bugs and the mortality of the eggs, a large number of eggs were collected in the field for examination. The eggs which were collected at different intervals and in different localities were examined daily. While thus examining the eggs it was noticed that some of them became dark in color instead of assuming the usual red coloring. These eggs were isolated and on May 19, there emerged from them three parasites. With these three parasites as a basis, the life history was carried through four generations, running up to July 5. Since this was the time between the two broods of the chinch bug, it became impossible to obtain additional chinch bug eggs with which to continue the work. From July 5 to July 23 only an occasional parasitized egg was found in the field, but beginning with the latter date, parasitized eggs were found in large numbers in the corn fields and the second generation was obtained by August 10. Up to the present date this year over 275 individual parasites have been bred out. The length of the life cycle has been found to vary from ten to eighteen days, depending on climatic conditions.

The parasite has been found in every wheat and corn field examined around Manhattan. Of 3,101 eggs collected between April 28 and June 10, the average percent of parasitism was 20.8, and of 116 eggs collected at Crawford (central Kansas) 19 eggs or 16.3 were parasitized.

The work is still under way and a full description of the parasite together with notes on its life history and efficiency will be published later. Mr. Crawford of the U. S. National Museum concludes that this parasite represents a new genus and species of the Proctotrypidæ.

JAMES W. MCCOLLOCH.

Swarming of Hemiptera. On the evening of July 1 of the present year, Boulder, Colorado, was visited by incalculable numbers of *Lygæus facetus* Say. Coming home at about 10.30 p. m., I found them in clouds about the electric lights, presenting the same appearance as the Trichoptera at certain seasons in the vicinity of the great lakes. They exhaled a strong and disagreeable cimicoid odor. In some parts of the town, I was informed, they were swept up with brooms. The weather here has been exceedingly hot and dry for many weeks, and one can only suppose that the bugs were compelled to migrate owing to the drying up of their usual food supply. Once before, in Boulder, I have observed a similar phenomenon, the species in this case being Homopterous. On September 21, 1908, I found on the steps and in the basement of the University of Colorado library enormous numbers of Homoptera, mostly dead. I nearly filled a small mason jar with them, and could have secured many more. The great majority, probably at least 90 per cent, were *Xerophlœa viridis* (Fabr.). The only other species at all abundant was *Limotettix exitiosus* Uhler. *Agallia uhleri* V. Duzee was the next in numbers. There were also some miscellaneous insects, including two *Nysius angustatus* Uhl., and one *Lygæus facetus* Say. The *Xerophlœa viridis* were nearly all of the green form, but pink and light brown individuals occurred in small numbers. The brownish variety is doubtless var. *grisea* (Germar). The species *X. viridis* ranges from Massachusetts to Brazil. The swarming of a Lepidopterous insect, *Homœosoma electellum*, at Boulder, has already been recorded in Entomological News.

T. D. A. COCKERELL.

Observations Regarding Flight of the Cotton Moth in 1911. In 1911, certain work on the canal of the Bulls Bridge power plant at Merwinsville, Conn., necessitated day and night work and to facilitate the latter we had a number of electric arc lights at the two points where work was progressing, there being six arcs at one point in a stretch of 300 feet and 10 or 12 lights at the other point in a section about the same length, perhaps 200 feet wide, both localities being in the valley of and close to the Housatonic River. On September 23, in reporting conditions at the work my representative stated there were "millions of moths" around the lamps and on Monday, the 25th, when I personally visited the work I found every one of the wooden frames, from which the arc lights were suspended (these frames consisting of an upright 4" x 6" and perhaps 10 feet high and a cross arm at the top about 5 feet long, from which the lamps were hung), covered with moths for the most part as closely together as they could get. These were almost entirely cotton moths. There were, however, 30 to 40 specimens of *Tolype velleda*, four or five Sphinx moths, several *Catocalas* and a few other species. The ground surrounding these lights was also completely covered with the moths and when disturbed they made a noise like the rustling of dry leaves. The superintendent reported that for two or three nights previously there had been far more than I found Monday morning; that at times

they crowded so thickly about the arc lights as to almost completely obscure them. I was not on the ground again for some little time, but was advised by the men that Monday night there was a very marked reduction in the number and that Wednesday night there was practically none at all. I had nothing except a bottle of chloroform with which to collect specimens, but by simply pouring this down one of the posts it was possible to secure plenty of specimens which were in excellent condition.

CHARLES RUFUS HARTE,
Construction Engineer.

A Rhododendron Borer (*Corthylus punctatissimus* Zimm.) This ambrosia beetle was found the latter part of September working in rhododendron stems. The borers entered the plants near or just a little below the surface of the ground and so thoroughly riddled the affected parts that the shoots wilted and were easily broken off. There were a series of closely set, circular, nearly horizontal galleries with numerous vertical brood chambers. These series were double or treble and were united by more or less vertical connecting galleries. The work of this borer was not found more than six inches above the ground and the galleries rarely extended more than two or three inches below the surface. We found no cases of root invasion though in some instances the insects worked close to the crown of the plant. This beetle seems a rather serious, though distinctly local pest in the vicinity of New York City. It can be controlled by cutting out and burning the affected stems. Care should be exercised not to break infested shoots since there is then danger of some of the beetles escaping destruction. The insect seems to display a marked preference for well shaded plants.

E. P. FELT.

THE 26TH ANNUAL MEETING OF THE AMERICAN ASSOCIATION OF ECONOMIC ENTOMOLOGISTS

The 26th annual meeting of the American Association of Economic Entomologists will be held in Atlanta, Ga., during the week beginning December 29, 1913, under the Presidency of Professor P. J. Parrott, of Geneva, N. Y. Arrangements will be made for holding sectional meetings of Horticultural inspection and Apiary inspection. During the week a program will be arranged so that closely related subjects will be grouped as much as possible.

During the same week the annual meeting of the Entomological Society of America will be held, and it is anticipated that many papers of great interest to working entomologists will be presented for consideration and discussion. The program of the meeting of this Association will be issued in the December number of the Journal, and this preliminary announcement is being made, so that all members may be advised and can make plans to be present at this important meeting.

A. F. BURGESS, *Secretary.*

JOURNAL OF ECONOMIC ENTOMOLOGY
OFFICIAL ORGAN AMERICAN ASSOCIATION OF ECONOMIC ENTOMOLOGISTS

OCTOBER, 1913

The editors will thankfully receive news items and other matter likely to be of interest to subscribers. Papers will be published, so far as possible, in the order of reception. All extended contributions, at least, should be in the hands of the editor the first of the month preceding publication. Contributors are requested to supply electrotypes for the larger illustrations so far as possible. The receipt of all papers will be acknowledged.—EDS.

The Ohio State University, in a recent issued circular, offers a comprehensive course in applied or economic entomology, extending through a period of four years, beginning with fundamental studies in zoology and making provision in later years for a study of various phases of applied entomology. This is a significant commentary upon the importance of practical work in this branch of science. The authorities of the University and the head of the department directly responsible for the venture, are to be congratulated upon taking this progressive step.

The international character of American work in economic entomology is becoming increasingly apparent with the progress of time. We were favored in 1911 by a visit from a noted German entomologist (a summary of his impressions is reviewed elsewhere in this issue), while this season a well-known French savant has been studying our methods. Students have begun to avail themselves of our special facilities for studying large-scale operations in practical entomology. This is a most sincere form of approbation and, while gratifying, should also prove stimulating. It is not sufficient to have attained the desired end. The leadership must be maintained and the latter may mean more strenuous efforts than the former.

Our friends from abroad have naturally had a better opportunity of seeing the strong, rather than the weak points in our system. Every American entomologist is cognizant of hampering conditions in some direction, occasionally in many. The demand for "immediate" or "practical" results is frequently insistent. There is often need of a better correlation between research and extension work, since one is apt to overbalance the other; the former may lose much of its effectiveness if there is too little of the latter, and vice versa. Inspection and quarantine service, desirable though they may be, absorb time and strength in some instances at least, from relatively more important work. Then, if in addition, a considerable amount of time must be given to instruction, it is obvious that some line of productive effort

must be slighted. There is more or less undesirable duplication of work and overlapping of spheres of activity. These obstacles to the best progress are being gradually overcome, and for the most part it is gratifying to state that they are of minor importance, though noteworthy factors as competition becomes more keen.

Reviews

Entomology, with Special Reference to its Biological and Economic Aspects, by J. W. FOLSOM. Second revised edition, pages 402, plates 4, text figures 304. Blakiston Sons & Co. 1913.

The new edition of this standard work has been reset and thoroughly revised. Much new matter has been incorporated here and there, the most important being a chapter on the transmission of diseases by insects. There are several new figures, others have been improved, and over 100 titles added to the well selected and extensive bibliography. The slightly larger pages and thinner paper have effected a desirable reduction in thickness and weight. The colored plate of the first edition is omitted in the revision, and the same is true of a chapter on origin of adaptations and species.

We have in this volume an admirable summary of the fundamentals of insect biology and ecology, with special reference to the economic applications. It is an invaluable supplement to our somewhat numerous taxonomic works. Familiarity with its contents is one of the best possible preparations for the economic entomologist, the man who is primarily concerned in ascertaining biological relationships. This edition, price $2.25, should be in the library of every working entomologist.

The Reduction of Domestic Flies, by EDWARD HALFORD ROSS. 103 pages, 18 illustrations; J. B. Lippincott Company, Philadelphia, and John Murray, London. 1913. Net, $1.50.

This volume is a companion to the author's "The Reduction of Domestic Mosquitoes" which appeared a year or more ago. It is written by an Englishman and from an English standpoint. The book contains twelve chapters with titles as follows: "The Importance of Domestic Flies; The Fly-Egg, the Larva, and the Chrysalis; The Life and Habits of Domestic Flies; The Fly's Enemies; How to Reduce Flies; The Beginning of the Anti-Fly Campaign; Early Fly Reduction; The Organized Anti-Fly Campaign; Opposition; The Justification of Expenditure of Money and Energy; The Life and Death of *Worry* the Fly; Sanitary Education, Flies, and the Coming Generation."

This book is not without faults, yet it has a mission, for many will see it in libraries and from it learn how to start a campaign against flies. The sooner that the people are interested and educated in insect sanitation, the better for human life and health. We should therefore welcome any intelligent discussion of the subject, though there is no better authority, or one whose advice is safer to follow, than our own Doctor L. O. Howard.

W. E. B.

A Laboratory Guide to the Study of Parasitology, by W. B. HERMS. The Macmillan Company, p. 1–72, 1913.

The teacher of biology will find much suggestive in this guide to the study of parasitology, using this term in a somewhat broad sense and with special reference to its economic bearings. The author has not hesitated to include one or two forms which may not prove to be pathogenic, since it is comparatively easy to omit a lesson or two. Outlines are given for the study of various types of insects mouth-parts and their bearing on the dissemination of disease elucidated. Representative types, such as the bird and true lice, bed bugs, cone-noses, mosquitoes, horse flies, house flies, stable flies, etc., are assigned to one or two periods of two and one-half to three hours. Parasiticides, amoebæ, trypanosomes and malarial parasites are also provided for in the course, a total of about 40 lessons.

Part 2 is devoted to helminthology, the various types of worms being studied in much the same way, one lesson dealing with anthelminthics.

The provision for biological work in part 3 adds greatly to the value of the guide in our estimation since the students thus have an opportunity of seeing a portion of the processes in operation. The author has naturally selected for this easily obtained and handled forms such as the house fly, the mosquito and flea.

There is enough in each lesson to guide the student working under competent direction though comparatively little can be learned from the guide itself. The student is compelled to study the material or rely in large measure upon the instructor, our ideal in laboratory guides.

Biologien heimischer Schmetterlinge schädlich in Garten, Feld und Wald. By PAUL IHLE. Böhler u. Recke, Biebergasse 8, Frankfurt a. Main, Germany. Three Series. Marks 22.50.

This recent publication consists of a collection of thirty colored plates of the different stages in the life history of some of the more common insect pests of the gardens, fields and forests of Europe, each plate accompanied by explanatory inscriptions. The coloring is excellent (the writer has compared the plates with specimens of the insects), and the drawing good.

Perhaps the work will be of most value in North America to those engaged in the inspection of imported nursery stock, as many of the insects figured are liable to reach this country on importations, and a study of the figures of the different stages should be of great assistance to inspectors, teaching them what to watch for. The low cost of the work (about $5.75) should bring it within the reach of all, and the importance of an acquaintance with the appearance in their different stages, of pests likely to reach this country at any time would seem self-evident. The writer is informed that it is not unlikely that additional series and descriptive text may be issued later if the demand should seem to justify it. G. E. Stechert & Co. of New York are handling the work.

H. T. F.

Die Angewandte Entomologie in den Vereinigten Staaten (Applied Entomology in the United States) by K. ESCHERICH, pages 196, figures 61, Paul Parey, Berlin. 1913.

This work contains much familiar to Americans and is of interest because it records the impressions of a gifted European qualified by experience to pass expert judgment.

The journey was made possible through the generosity of Mr. Carnegie. The author's itinerary included Washington and most of the Federal Field Stations as well as a number of the more important (from an entomological standpoint) Agricultural Experiment Stations, Entomological Departments of Universities and offices of State Entomologists. The first part discusses organization and agencies, and the second gives a summary of control methods as practised in this country. The critical remarks upon the biological method of controlling insects are especially valuable and a translation of these by Dr. E. A. Schwarz, transmitted through the courtesy of Dr. Howard, follows:

"We have now learned [in the preceding chapters] of a variety of biologic warfares. The success of them was very diversified; excellent in some cases; in others less satisfactory, and, again, in others entirely negative. From this fact it is to be concluded: (1) It is not an Utopia [a dream] *but an established fact that insect calamities can be successfully fought and terminated by artificial multiplication or importation of parasites;* (2) *but on the other hand we learn therefrom that the biologic method does not constitute an universal remedy.*

"It is self evident that a warfare by means of parasites can only be successful where the devastation is due to a scarcity or absence of parasites. There is a whole series of insect eruptions which are caused by other factors: for instance, the multiplication of Scolytid beetles depends much less upon the diminution of the number of parasites and enemies than on the increase of food material. In this case it would be of no use to introduce *Clerus formicarius* and the various Ichneumonids if at the same time care had not been taken to remove the dying trees. Or, take the case of the Phylloxera which in the vineyards of Europe does such tremendous damage. It would be a useless attempt to counteract this pest with natural enemies. For it is not the absence of such enemies which renders the Phylloxera such a dreadful pest in Europe, but the real cause is the smaller power of resistance of the grape vines. Many similar instances could be given.

"But apart from such cases where the biologic method necessarily appears to be excluded, there are still other cases where in spite of apparent possibility the biologic warfare is not employed and the mechanical warfare is preferred, namely in cases where we have to deal with a very short outbreak and where we have immediately to use remedies; or in cases where we have on hand cheap, easily applicable and sure, mechanically acting remedies. For we must not lose sight of the fact that parasites and enemies are also subject to all sorts of influences by which their efficacy is again lowered or delayed so that the degree of the efficiency [of the biologic method] can not be foretold with the same degree of certainty as with many technical methods.

"Finally there are cases where the biologic method is to be used only to assist the mechanical method. For instance, where the caterpillars are, by the lime rings, prevented from ascending the trees, the efficacy of this mechanical remedy can be essentially increased by the protection and introduction of parasites, etc.

"That the Americans are fully and correctly aware today of all these points, is made sufficiently clear from the foregoing report [i. e. in the body of the book]. To be sure, there was a time when too optimistic views were indulged in by some, and when the biologic warfare was considered as an almost universal remedy,—namely at the time when the importation of *Novius cardinalis* resulted in such a wonderful success. But those times are gone. At least the leading entomologists of America, with Howard in their lead, never think of fighting all pests with parasites; they are too well aware that this method is only adapted to certain specific cases. And further, they have also learned in the meantime that the introduction and acclimatization of parasites is not always such an easy matter as in the case of *Novius*

cardinalis, and that, on the contrary, this method is, in most cases, connected with great difficulties. What enormous amount of the most serious scientific work on the part of the investigators to place the introduction of the parasites of the Gypsy moth on a sure basis! *It is only when the life-histories of the parasites in all their peculiarities are fully studied and when their mode of attacking and the degree of attack on the host have been exactly ascertained—only then the practical utilization of parasites can be thought of. This is the 'Axiom' of the biologic warfare* which today is strictly adhered to by Howard and his school.

"If there were many errors committed at first, and if many costly experiments were failures—this is only natural. Through Error to Victory! Most of our modern roads do not lead to their destination in a straight line, and frequently it is through failures that we advance the farthest! [P. 131.] We should rejoice that the Americans have gone through the most difficult part of this road, *and we should now not longer hesitate to join them and, for the benefit of forestry and agriculture, to follow them, shoulder to shoulder, on the road which they have conquered after such a hard struggle.* For it can not be doubted that the biologic method has still a promising future and that it will occupy a constantly broadening part in the warfare against insect pests."

The author gives an excellent historical summary of the development of applied entomology in this country, taking the work of the Federal Bureau of Entomology as a criterion and discussing activities of other entomologists wherever necessary to round out the account, and finds much to commend. The illustrations are mostly from the publications of the Bureau of Entomology. The author was so deeply impressed with the soundness of our methods that he advocates for Germany a similar system with some modifications and has taken preliminary steps for the formation of an Association of Economic Entomologists similar to that in this country.

Current Notes

Conducted by the Associate Editor

Mr. A. B. Shaw has resigned as assistant in entomology at the California University and Station.

The appropriations to the Ohio Station for 1913, made by the legislature, include $8,000 for entomology.

Mrs. Anna Botsford Comstock has recently been appointed assistant professor of entomology and nature study in Cornell University.

Mr. H. L. Viereck was with the Minnesota State Entomologist during August and September.

At the California University and Station, G. A. Coleman, E. C. Van Dyke and L. J. Nickels have been appointed instructors, and R. E. Campbell as assistant in entomology.

Mr. Charles W. Howard was promoted from instructor to assistant professor of entomology, University of Minnesota, by the Board of Regents, at the June meeting.

Mr. Harry Pinkus, an agent of the Bureau of Entomology and an associate member of this Association, died, August 27, at Dallas, Texas.

At the Ohio State University a new biological building is being erected. It will house the departments of zoölogy and botany and will be provided with greenhouses and an insectary.

Professor J. S. Kingsley, for twenty-one years professor of zoölogy in Tufts College,

has recently been appointed professor of zoölogy at the University of Illinois. He will there have charge of the vertebrates.

Mr. Dayton Stoner, instructor in zoölogy at the State University of Iowa, spent the summer in the insectary of the Iowa Experiment Station at Ames.

Sir Patrick Manson, at the recent International Medical Congress, was presented with a gold plaque symbolical of triumph over tropical diseases.

Dr. W. L. Tower, of the University of Chicago, has been made curator of the new bionomic laboratory, and has gone to South America to collect material for it.

Professor Ernest Walker, formerly of the University of Kansas, has recently been appointed head of the horticultural department of the Alabama College and Station.

Professor T. D. A. Cockerell, professor of zoölogy at the University of Colorado at Boulder, was given the honorary degree of Sc.D. by Colorado College at its last commencement in June.

Colonel William C. Gorgas has been invited to visit Johannesburg, South Africa, to advise regarding sanitary conditions there. He has asked for a leave of absence that he may accept the invitation.

Professor C. E. Bartholomew of the Agricultural College at Ames, Iowa, had charge of the instruction in entomology at the Macbride Lakeside Laboratory on West Lake, Okoboji, Iowa, during the summer.

Mr. M. P. Somes, assistant entomologist of the South Carolina Agricultural Experiment Station, has been appointed entomologist of the Missouri Fruit Experiment Station at Mountain Grove, Mo., where he should now be addressed.

Professor H. A. Morgan, Director of the Tennessee Station, visited Europe in the summer as a member of the Southern Commercial Congress, to study the rural credit systems there.

Mr. G. P. Weldon has resigned as assistant entomologist of the Colorado Station and instructor in the college, to accept a position as Chief Deputy Commissioner of Horticulture in California, succeeding Mr. Geo. E. Merrill.

Mr. Irving W. Davis, B.S., a graduate in 1911, of the Massachusetts Agricultural College at Amherst, Mass., has been appointed assistant in entomology at the Connecticut Station at New Haven, and has taken up his work there.

Mr. A. C. Mason, B. S., a graduate of the Michigan Agricultural College, class of 1913, has been appointed laboratory assistant in entomology under Professor J. R. Watson, at the Agricultural Experiment Station, Gainesville, Fla., and began his work July 1.

Dr. A. D. Ihms has been appointed Reader in Agricultural Entomology in the Victoria University of Manchester, England. He was formerly professor of biology in the University of Allahabad and afterwards Forest Entomologist to the Government of India at the Imperial Research Institute, Dehra Dun, India.

Mr. W. O. Ellis, instructor in zoölogy at the Iowa State College, has gone to Washington State College as instructor in zoölogy and assistant in entomology in the experiment station. Mr. Ellis served as an insectary assistant at the Iowa station during the past summer.

According to *Science* Dr. J. E. Wodsedalek, formerly of the zoölogical department of the University of Wisconsin, has been appointed professor of zoölogy and head of the department of zoölogy and entomology at the University of Idaho, Moscow, Idaho, as a successor to J. M. Aldrich.

Professor C. T. Brues, Bussey Institution, Forest Hills, Mass., was a member of a special expedition to Peru led by Dr. Richard P. Strong, from the Harvard Medical School, to study infectious diseases of South and Central America. The party sailed from New York April 30th and will return in the fall.

Paul S. Welch Ph. D. has been appointed instructor in the college and assistant

in the Station in the department of entomology, Kansas Agricultural College, in place of Dr. M. C. Tanquary, who resigned to accompany the Crocker Land Expedition.

Dr. John W. Scott, assistant professor of zoölogy, Kansas Agricultural College, has resigned to become professor and head of the department of zoölogy and parasitology at the University of Wyoming. His place at Kansas has been filled by the appointment of Dr. J. E. Ackert, of the University of Illinois.

H. F. Wilson has been appointed head of the entomological department at the Oregon College and Station, and hereafter Professor A. B. Cordley will give his entire time to his work as dean of the school of agriculture. A sub-station has been established at Hood River for the purpose of studying the fruit insects and diseases.

Mr. James F. Zimmer formerly in charge of the Insecticide Testing Laboratory of the U. S. Bureau of Entomology at Vienna, Va., has resigned to accept a position as Assistant State Leader in Farm Management, at Manistee, Mich. His duties will be to Assist the fruit growers and farmers along the eastern shore of Lake Michigan.

Professor A. G. Ruggles, who was granted leave of absence that he might serve as entomologist for the Pennsylvania chestnut tree blight commission, has returned to his work at the University of Minnesota. The Pennsylvania work was stopped because the appropriation was considered inadequate and was vetoed by the Governor.

Mr. W. F. Fiske, formerly of the Bureau of Entomology and with headquarters at the Gypsy moth parasite laboratory, Melrose Highlands, Mass., is now employed in connection with investigations into the Trypanosome diseases of man and domestic animals in Africa. His address is, Care of Tropical Diseases Committee, Royal Society, Burlington House, London, England.

Professor A. J. Cook, horticultural commissioner of California recently had to face charges of incompetency made by a self appointed body called the Horticultural Welfare Committee. This committee claimed that Professor Cook's administration has been injurious to the fruit industry of the state. No case was presented, however, against Professor Cook, who was wholly and emphatically vindicated by Governor Hiram Johnson.

Mr. E. P. Van Duzee, formerly of Grosvenor Library, Buffalo, N. Y., is now at Scripps Institution, La Jolla, California, where he divides his time between library work and in studying the hemiptera. Mr. Van Duzee will probably remain on the Pacific coast, and will continue his work in entomology, being now engaged in preparing a catalogue of North American Hemiptera. Correspondents should send letters and specimens to the address given above.

According to *Science* "Mr. C. W. Mason of Wye, England, and Mr. Donald McGregor of Oxford, have been appointed Carnegie scholars in entomology under the Imperial Bureau of Entomology. Mr. Mason arrived in the United States early in July and is now studying at the laboratory of parasitology of the Bureau of Entomology of the United States Department of Agriculture at Melrose Highlands, Mass. He will study in this country for one year. Mr. McGregor will arrive in New York soon and will probably join Mr. Mason at Melrose Highlands."

The American and the Pacific Coast Associations of Nurserymen, which met in joint convention at Portland, Ore., passed resolutions and appointed a committee to aid in bringing about more uniform legislation regarding inspection and certification of nursery stock in the different states. The following standing committee was appointed to take charge of the work: William Pitkin, Rochester, N. Y., Chairman; Peter Youngers, Geneva, Neb., Treasurer; M. McDonald, Orenco, Ore.

Professor W. T. Shaw, zoölogist of the Experiment Station, professor of Zoölogy

and Curator of the museum in the college, Pullman, Wash., will be acting head of the department of Entomology and Zoölogy for the coming year, during the absence of Professor A. L. Melander, who has been granted a year's leave of absence for research work at Harvard. Mr. M. A. Yothers, Assistant Entomologist of the Station, will have charge of entomological investigations. Mr. E. O. Ellis, who this spring received his Master's degree from the Iowa Agricultural College, has been elected to the position of Instructor in Entomology, and Assistant in Entomology in the Station.

The apicultural department of the Agricultural College at Amherst, Mass., has been strengthened by increasing the apiary and by appointing a superintendent in the person of Mr. John L. Byard, of Southboro, Mass., formerly a deputy apiary inspector in the state. Mr. Byard is now president of the Massachusetts State Beekeepers' Association and for three years was president of the Worcester County Beekeepers' Association. He has a wide acquaintance with the beekeepers of his state and a good knowledge of his subject, having been generally recognized as a successful apiculturist. Mr. Byard will assist in laboratory and demonstrational work with students and at institutes and conventions, but his services will be chiefly confined to the maintenance of the college apiary and its equipment.

Science is responsible for the statement that "Mrs. A. H. Clarke, of Earl's Court, has given to the University of London the collection of continental and exotic macrolepidoptera made by her late husband, who was one of the senior fellows of the Entomological Society. The section of exotic butterflies consists of nearly 6,000 specimens from all parts of the world, and is particularly valuable as a reference collection, not merely from the number and careful selection of the forms represented (some being of great rarity), but from the perfect condition and beauty of the specimens themselves. The whole donation comprises over 12,000 specimens all carefully set, arranged and labeled; and to it Mrs. Clarke has added her husband's working library of entomological literature. After the work of arranging and cataloguing has been concluded, the collections will be available for reference by entomologists generally upon application to the professor of zoölogy at the university."

According to Canadian Entomologist, Mr. John D. Tothill, B. S. A., a graduate of the Ontario Agricultural College, Guelph, has been awarded the Carnegie Scholarship in Entomology in order to enable him to take a year's post graduate course at Cornell University. The value of the scholarship is $625.00 and includes traveling expenses. These scholarships are somewhat similar in character to the Rhodes scholarships at Oxford and are intended to enable qualified young men in various parts of the British Empire to spend a year in study at some University in the United States. Mr. Tothill is a field agent of the Division of Entomology at Ottawa, and is at present carrying on investigations under the direction of Dr. Hewitt, on the work of parasites of the Brown-Tail Moth in N. B., his headquarters being at Fredericton.

The Division of Entomology of the Minnesota Experiment Station has adopted the Sectional plan. All sections are of equal rank. One section, comprising spraying and shade tree and forest insects, is under the direction of Mr. A. G. Ruggles. Mr. William Moore of Cornell, just returned from South Africa, has charge of the section on Greenhouse and truck crop insects. Mr. C. W. Howard, from South Africa, also a Cornell graduate, has charge of the section on Forage crop insects and also insects and diseases. Mr. A. J. Spangler is chief nursery inspector under the direction of the State Entomologist who has, by law, that work in charge.

Mr. Charles H. T. Townsend, Government Entomologist and Director of Entomological Stations, was some time ago especially charged by the Peruvian Government with the investigation of the insect transmission of verruga. On the 30th of June, he announced, from the entomological evidence alone, the practical certainty that

Phlebotomus was the verruga vector. On July 11 he injected a dog with triturated bodies of females of the *Phlebotomus*, and secured the verruga eruption on July 17 as a result. This is the first case of experimental transmission of the disease through the medium of insects. Details of the case are being published. This investigation has furnished another striking illustration of the value of expert entomological work. For thirty years the medical fraternity of Peru has labored to solve the mystery of the origin and transmission of verruga. Yet six months' work by a practical entomologist has definitely indicated the carrier. The result is that the disease loses its mystery and can be confidently guarded against. It was possible to draw up a practical demonstration of *Phlebotomus* as the transmitting agent from the entomological investigation alone, without waiting for the transmissional proof. The Peruvian authorities are fully alive to the importance of the discovery.

Mr. D. L. Crawford, Entomologist and Horticulturist of the Mexico Gulf Coast Citrus Fruit Association, located at Apto. 293, Tampico, Mexico, has just issued a circular on the Control of the Orange Maggot. This is the first of a series which may appear at regular intervals and also embody the results of his investigations of other insects. Mr. Crawford will gladly supply this circular upon application by interested parties.

The Ohio State University has established a course in Applied Entomology and announces a course of study, leading to a Bachelor of Science degree, to cover four years of under-graduate work, including such subjects as Modern Language, Chemistry, Botany, Zoölogy, Geology, Horticulture and Agronomy, besides a number in strictly technical Entomological works. It is intended to fit students for technical work in the Bureau of Entomology, Experiment Stations, State and Federal Quarantine Service or as Investigators in Boards of Health or other professional positions.

The following notes are copied from The Review of Applied Entomology for August, page 304:

Mr. R. H. Deakin has been appointed as Assistant Entomologist at Nairobi, East Africa Proctectorate. Mr. F. P. Jepson, Government Entomologist of Fiji, left Java in July, having been there to search for parasites of the Banana Weevil (*Cosmopolites sordidus*, Germ.). Dr. W. A. Lamborn has been appointed as Entomologist of the Department of Agriculture, Southern Nigeria, in the place of Mr. A. Peabody (invalided). Mr. Gilbert Storey has been appointed as Assistant Entomologist to the Egyptian Department of Agriculture. The appointment of Mr. F. W. Urich as Entomologist to the Board of Agriculture has been renewed for a further period of two years. The vacant Carnegie Scholarships of the Imperial Bureau of Entomology have been allotted to the following gentlemen: Mr. R. E. McGregor, Trinity College, Cambridge, for two years; Mr. A. R. Ritchie, Glasgow University, for two years; Mr. C. Mason, South-Eastern Agricultural College, Wye, for one year; and Mr. J. W. Tothill, Assistant Entomologist, Dominion of Canada, for six months. The Sleeping Sickness Commission of the Royal Society have arranged to send Mr. W. F. Fiske (lately of the U. S. A. Bureau of Entomology) to East Africa in September, for the purpose of studying the bionomics of *Glossina*.

Mailed October 29, 1913.

TWENTY-SIXTH ANNUAL MEETING OF THE AMERICAN ASSOCIATION OF ECONOMIC ENTOMOLOGISTS

Atlanta, Ga., December 31, 1913, to January 2, 1914

The twenty-sixth annual meeting of the American Association of Economic Entomologists will be held at the Atlanta Medical College, Atlanta, Ga., beginning December 31, 1913, and ending January 2, 1914. The opening session will be called to order at 1.30 p. m. on Wednesday, December 31, when the opening business of the meeting will be transacted and the address of the President will be delivered. The meeting will continue on Thursday morning and afternoon, and the final session will be held at 10 a. m. Friday morning, January 2, 1914.

Sectional Meetings

The meeting of the section of Apiary Inspection will be held at 10 a. m. on Thursday, January 1, at which time the business of the section will be transacted. A meeting of the section of Horticultural Inspection will be held on Thursday at 1.30 p. m., when the papers will be presented and general discussions on matters bearing on Horticultural Inspection will take place.

Other Meetings

The American Association for the Advancement of Science and its affiliated societies will hold meetings throughout the week. The meeting of the Entomological Society of America will be held on Tuesday, December 30, and on Wednesday morning, December 31. The public lecture before that Society will be delivered on Wednesday evening, December 31, by Dr. E. P. Felt, State Entomologist of New York. The subject will be "Gall Insects."

Smoker

A smoker for the visiting Entomologists will be held on Thursday evening. The exact time and place will be announced during the meetings.

Hotel Headquarters

Hotel headquarters for this Association and for the Entomological Society of America have been arranged for at the Ansley Hotel,

corner of Walton and Gore Streets, where rates on the European plan have been secured, ranging from $1.00 to $3.50 per day. Members are urged to make hotel reservations as early as possible, so that there will be no confusion in securing special accommodations.

Railroad Rates

Information in regard to railroad rates has been secured from Dr. L. O. Howard, Permanent Secretary for the American Association for the Advancement of Science.

A railroad rate of one fare and three-fifths for the round trip, on the certificate plan, conditioned upon the presentation at the meeting of not less than 200 certificates, has been granted by the Trunk Line Association. Decision has not yet been received from the New England Passenger Association, but it is believed that it will concur in the same arrangement. The Central and the Eastern Canadian Passenger Associations have refused concessions.

(*As the above reduction in the rate to fare and three-fifths is contingent upon the presentation of a minimum of 200 certificates, as against a minimum of 100 as in previous years, every member traveling from the Trunk Line and the New England Passenger Association territories is urged to procure his certificate. Failure to do this may result in less than 200 certificates being presented and, as a consequence, all other members from this territory will be deprived of the reduced rate on the return trip.*)

The following directions are submitted for the guidance of members traveling from the Trunk Line and the New England Passenger Association territory:

1. Tickets at full fare for the *going* journey may be secured within three days prior to, and during the first three days of the meeting. The advertised dates of the meeting are December 29, 1913, to January 3, 1914, consequently you can obtain your tickets not earlier than December 25, 1913, and not later than December 31, 1913.

From points located at a great distance, from which it takes more than three days to reach Atlanta, going tickets may be purchased on a date which will permit members to reach Atlanta by December 29, 1913.

2. Present yourself at the railroad station for ticket and certificate at least thirty minutes before departure of the train.

3. Certificates are not kept at all stations. If you inquire at your station you will find out whether certificates and through tickets can be obtained to the place of meeting. If not obtainable at your

home station, the agent will inform you at what station they can be obtained. You can in such case purchase a local ticket thence, and there purchase through ticket and secure certificate to place of meeting. Be sure that, when purchasing your going ticket, you request a *certificate. Do not make the mistake of asking for a receipt.*

4. On your arrival at the meeting, present your certificate to Mr. F. S. Hazard, assistant secretary, A. A. A. S. It has been arranged that the special agent of the Trunk Line Association will be in attendance at the office of the Permanent Secretary, to validate certificates daily (9 a. m. to 6 p. m.) from Monday, December 29, 1913, to Saturday, January 3, 1914, both dates inclusive. *A fee of 25 cents will be charged at the meeting for each certificate validated.* If you arrive at the meeting and leave for home prior to the special agent's arrival, or if you arrive at the meeting later than January 3, after the special agent has left, you cannot have your certificate validated, and consequently you will not get the benefit of the reduction on the home journey. *No refund of fares will be made on account of failure to have certificate validated.*

If the necessary minimum of 200 certificates is presented, and your certificate is duly validated, you will be entitled, up to and including January 7, 1914, to a continuous passage ticket to your destination via the route over which you made the going journey, at three-fifths of the limited fare.

The Southeastern Passenger Association has published Joint Tariff No. Exc. 5796, I. C. C. No. F-2402 (in effect December 27, 28 and 29, 1913), for excursion fares to Atlanta and return covering practically all railroad lines in its territory. Reasonable concessions are indicated therein.

The Southwestern Passenger Association offers no special rate, but suggests that members take advantage of the regular Christmas Holiday excursion rates to points in the Southeast.

The Western Passenger Association states that the fares in a large part of its territory are now on the basis of two cents a mile, which affords practically the same reduction as was formerly granted on the certificate plan.

From the States of California, Nevada, Oregon, Washington, and West of and including Mission Junction, B. C.; also from what are known as Kootenay common points, namely, Nelson, Rossland, Sandon, Kaslo and Grand Forks, B. C., the Transcontinental Passenger Association has on sale daily Nine-Months Tourist fares, approximating two cents a mile in each direction. The nine-months fares

apply to the eastern gateways of the Transcontinental territory which are:

Atchison, Kansas,
Chicago, Illinois,
Colorado Springs, Colorado,
Council Bluffs, Iowa,
Denver, Colorado,
Fort Worth, Texas,
Houston, Texas,
Kansas City, Missouri,
Leavenworth, Kansas,
New Orleans, Louisiana,
Omaha, Nebraska,
Pueblo, Colorado,
Memphis, Tennessee,
Mineola, Texas,
Minneapolis, Minnesota,
St. Joseph, Missouri,
St. Louis, Missouri,
St. Paul, Minnesota.

Station agents will cheerfully advise delegates as to the eastern points to which it will be most advantageous for them to purchase nine-months tickets in rebuying through to Atlanta.

Proportionately higher fares are made to principal Atlantic seaboard points and to interior points such as New York, N. Y.; Baltimore, Md.; Philadelphia, Pa.; Washington, D. C.; Boston, Mass.; Montreal, Quebec; Albany, N. Y.; Pittsburgh, Pa.; Buffalo, N. Y.; Detroit, Mich.; Toronto, Ontario; Cincinnati, Ohio; Indianapolis, Ind.; Atlanta, Ga., etc.

The nine-months fares do not apply to intermediate or interior points, but only to what are known as the eastern gateways of the Association, such as those named, including also Colorado Common Points. Should it happen that delegates apply at a station on the Pacific Coast from which the nine-months fare is not in effect, which may be the case at very small, unimportant stations, the agent will cheerfully ascertain and advise them the nearest point to his station from which such fare does apply.

It is suggested that advantage be taken of such excursion fares as may be in effect at the time of the meeting. Members should, therefore, consult their local ticket agents regarding routes and rates. Parlor and sleeping car accommodations should be reserved in advance.

Official Buttons

The official button of this Association will be supplied to all members whose dues are paid including dues for the year 1914. This will be furnished at the meeting on application to the Secretary.

Program

Wednesday, December 31, 1913, 1.30 p. m.

Report of Secretary.

Report of executive committee, by President Parrott.

Report of employment bureau, by F. L. Washburn, St. Anthony Park, Minn.

Report of committee on nomenclature, by Herbert Osborn, Columbus, Ohio.

Report of committee on entomological investigations, by T. J. Headlee, New Brunswick, N. J.

Report of committee on incorporation, by E. P. Felt, Albany, N. Y.

Appointment of committees.

Miscellaneous business.

Reference to committee for consideration of the proposed amendment to the constitution.

In article 3, section 1, "The officers shall consist of a president, two vice-presidents, who shall be elected annually and a secretary who shall be elected for a term of three years . . ."

Amend by striking out the words, "Two vice-presidents," and insert instead the words, "one vice-president and an additional vice-president for each section."

New business.

Annual address of the President, P. J. Parrott, Geneva, N. Y. "The Growth and Organization of Applied Entomology in the United States."

Reading of Papers

"Today's Work in Applied Entomology," by F. L. Washburn, St. Anthony Park, Minn. (12 minutes.)

A review of recent work in economic entomology.

"County Organization in the Boll Weevil Campaign," by W. E. Hinds, Auburn, Ala. (10 minutes.)

Information concerning organization of county agricultural advisory committees, coördinating and promoting all movements for rural betterment and bringing merchants and farmers *et al.* into helpful coöperation.

"Entomological Work in Missouri," by Leonard Haseman, Columbia, Mo. (10 minutes.)

A brief discussion of the work which the Department of Entomology is now doing and our plans for extending the work in the future.

"Grasshopper Control Work in Western Kansas," by George A. Dean, Manhattan, Kans. Lantern. (15 minutes.)

A brief review of the Grasshopper situation during the last three years. The serious outbreak of the summer of 1913. The organization for a systematic fight. The distribution of 1875 tons of poisoned bran mash. The result of the campaign.

"Report of Field Work on the Southern Corn Bill Bug, *Sphenophorus callosus*," by Z. P. Metcalf, Raleigh, N. C. (5 minutes.)

"The present Organization and Methods used by the Bureau of Entomology on the Gipsy Moth Work," by A. F. Burgess, Melrose Highlands, Mass. (15 minutes.)

"A Simple and Economical Method of Filing Entomological Correspondence," by Wilmon Newell, College Station, Texas. (10 minutes.)

Ordinary pasteboard letter files are used for filing and the correspondence handled by subjects in such a manner as to eliminate the use of filing cabinets, index cards, folders, and transfer cases. The file is self-indexing and has been found practical andefficient in handling correspondence for the past four years.

"Some New Insects of Economic Importance in the State of Washington," by M. A. Yothers, Pullman, Wash. (10 minutes.)

A brief discussion of the occurrence of new species of "Weevils" found in destructive numbers on fruit trees in the arid regions of the state.

Adjournment.

Program

Thursday, January 1, 10 a. m.

Discussion of the Presidential Address

READING OF PAPERS

"Can Insects become Immune to Spraying?" by A. L. Melander, Pullman, Wash. (12 minutes.)

"The Reaction of Sugar Maples to Miscible Oils," by E. P. Felt, Albany, N. Y. (7 minutes.)

"Some Factors Affecting Results in the Use of High Temperature for the Control of Insects Injuring Cereal Products," by W. H. Goodwin, Wooster, Ohio. (10 minutes.)

"The Relation of Temperature to Insect Development," by L. M. Peairs, Morgantown, W. Va. (10 minutes.)

"Soil Fumigation for Subterranean Insects," by J. A. Hyslop, Washington, D. C. (10 minutes.)

"Further Experience with an Insectary," by W. C. O'Kane, Durham, N. H. (10 minutes.)

Some difficulties experienced, changes made, cost.

"Life History of the Bee Moth or Wax Worm," by F. B. Paddock College Station, Texas. (10 minutes.)

A brief review of the life history of this insect as established by experimental work at College Station, Texas. There are in this latitude three generations. Carbon bisulfide has been found to be very effective in the control of this pest.

"Oviposition of two Apple Pests," by Glenn W. Herrick, Ithaca, N. Y. (10 minutes.)

"The lesser Peach Borer, *Sesia pictipes*," by H. A. Gossard, Wooster, Ohio. (5 minutes.)

Life history studies in the Lake Erie fruit belt.

"Some notes on the Box Leaf Miner," by A. E. Stene, Kingston, R. I. (10 minutes.)

Notes on the appearance of this insect in Rhode Island. Its present distribution and observations on its life history and methods of control.

"Notes on two new Pests of the Currant and Gooseberry," by R. A. Cooley, Bozeman, Mont. (10 minutes.)

Notes on the life history, economic importance and means of controlling a weevil, injuring fruit of the currant and a species of thrips injuring the foliage of the currant and gooseberry.

Adjournment.

Program

Thursday, January 1, 1.30 p. m.

READING OF PAPERS

"The Occurrence of the Warble Fly, *Hypoderma bovis*, in Canada," by C. Gordon Hewitt, Ottawa, Canada. (5 minutes.)

"Control of the Onion Thrips and Onion Maggot," by H. T. Fernald, Amherst, Mass. (10 minutes.)

"A New Destructive Cutworm of the Genus Paragrotis Occurring in Western Canada," by Arthur Gibson, Ottawa, Canada. (5 minutes.)

Preliminary note on the occurrence and destructive nature of a new enemy of cereals.

"Reducing Insect Injuries on Stored Corn," by W. E. Hinds, Auburn, Ala. (15 minutes.)

Outlining factors predisposing to injury, extent of injury, methods of preventing and reducing it.

"The Western Corn Root Worm in the South," by Geo. G. Ainslie, Nashville, Tenn. (5 minutes.)

"Thrips attacking Oats," by C. Gordon Hewitt, Ottawa, Canada. (10 minutes.)

"The Life History of the Green Soldier Bug, *Nezara hilaris*," by R. D. Whitmarsh, Wooster, Ohio. (5 minutes.)

"Experiments against the Tarnished Plant Bug as an Enemy of Peach Nursery Stock," by C. R. Crosby, Ithaca, N. Y. (10 minutes.)

"Further Data on the Control of the Fruit-tree Leaf Roller," by Glenn W. Herrick, Ithaca, N. Y. (10 minutes.)

"The Egg Laying Habits of the Pecan Twig Girdler, *Oncideres cingulatus* Say," by C. L. Metcalf, Raleigh, N. C. Lantern. (7 minutes.)

"Notes on Forest Insects," by E. P. Felt, Albany, N. Y. (10 minutes.)

"Notes on the Life History, Distribution and Efficiency of the Egg Parasite of the Chinch Bug," by J. W. McColloch, Manhattan, Kans. (10 minutes.)

This paper will deal with the length of the life cycle, number of broods, habits, distribution in Kansas, and percentage of parasitism at various times during the summer.

"The Parasites of the San José Scale in New York—Species and Distribution," by H. E. Hodgkiss and P. J. Parrott, Geneva, N. Y. (15 minutes.)

"Notes on Parasites in the Hawaiian Islands," by Otto H. Swezey, Honolulu, Hawaii. (10 minutes.)

"Relation of the Number of Larval Stages to the Development of Male and Female Gipsy Moths," by F. H. Mosher, Melrose Highlands, Mass. (10 minutes.)

Adjournment.

Program

Friday, January 2, 10 a. m.

READING OF PAPERS

"The Education of the Entomologists in the Service of the United States Department of Agriculture," by L. O. Howard, Washington, D. C. (15 minutes.)

"Observations on Insect Borne Diseases in Ecuador and Peru," by Charles T. Brues, Forest Hills, Boston, Mass. Lantern. (15 minutes.)

"Anti-Mosquito Work in New Jersey," by T. J. Headlee, New Brunswick, N. J. Lantern. (15 minutes.)

"A Remarkable Outbreak of *Culex pipiens* Linn." by W. E. Britton, New Haven, Conn. (10 minutes.)

Species appearing in West River, New Haven, Conn., where fish had been killed.

"Further Observations on the Breeding Habits of the House Fly and its Control," by C. Gordon Hewitt, Ottawa, Canada. (15 minutes.)

"Experiments With House Fly Baits and Poisons," by A. W. Morrill, Phoenix, Ariz. (10 minutes.)

Tests of the various fly trap baits and poisons used for house flies to determine their relative attractiveness and effectiveness.

Final Business

Report of committee on auditing.
Report of committee on resolutions.
Report of committee on membership.
Report of other committees.
Nomination of JOURNAL officers by Advisory Committee.
Report of committee on nominations.
Election of officers.
Miscellaneous business.
Fixing the time and place of next meeting.
Final adjournment.

SECTION OF APIARY INSPECTION

WILMON NEWELL, *Chairman.* E. F. PHILLIPS, *Secretary.*

Program

Thursday, January 1, 10.30 a. m.

Address by the Chairman, Wilmon Newell, College Station, Texas.

READING OF PAPERS AND DISCUSSIONS

"Bee-keeping and Apiary Inspection in Missouri," by Leonard Haseman, Columbia, Mo. (15 minutes.)

A brief report of the work of the State Apiary Inspector and the work which the Department of Entomology has undertaken.

The reading of papers will be followed by a discussion of Apiary Inspection in the United States.

Subject for discussion: "The Relation of the Inspection of Apiaries to other Factors for the Education of the Beekeeper."

Other papers which may be prepared by the members can be added to the program at the time of the meeting by making arrangements with the Secretary of the section.

Transaction of business.

Election of Section Secretary.

SECTION ON HORTICULTURAL INSPECTION

E. L. WORSHAM, *Chairman.* J. G. SANDERS, *Secretary.*

Program

Thursday, January 1, 1.30 p. m.

Address by the Chairman, E. L. Worsham, Atlanta, Ga.

READING OF PAPERS

"Nursery and Orchard Inspection Work in Missouri," by Leonard Haseman, Columbia, Mo. (15 minutes).

A discussion of the history of nursery inspection and inspection laws in Missouri and plans for carrying out the recently enacted state law.

"Some Problems Arising from the Administration of the Minnesota Inspection Law," by F. L. Washburn and A. J. Spangler, St. Anthony Park, Minn.

"The Gipsy Moth and Brown-Tail Moth Quarantine in New England," by D. M. Rogers, Boston, Mass.

General discussion of horticultural inspection problems.

It is expected that the Federal Horticultural Board will be represented at this meeting and that a report on the work of the Board will be presented.

Other papers can be added to the program by making arrangements with the Secretary of the section.

Transaction of business and election of Section Secretary.

A. F. BURGESS, *Secretary,*
Melrose Highlands, Mass.

P. J. PARROTT, *President,*
Geneva, N. Y.